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Louisiana's Alcohol-Impaired Driving Problem: An Analysis of Crash and Cultural Factors

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Though national trends regarding culture and drinking are well documented, behaviors specific to Louisiana's diverse cultural makeup are not. This analysis addresses this need. A review of the research literature identified cultural groups and how those different groups approach age of first consumption, consistent alcohol usage, and binge drinking. The analysis of previous research identified key risk factors associated with alcohol-involved crashes. This analysis was performed at two spatial levels: parish and census block group. Descriptive statistics were computed at the parish level, followed by a comprehensive systemic analysis at the block group level. High-risk locations were identified at a granular level, including the top 50 block groups. A survey of the general population demonstrated that a large proportion of respondents perceived drinking and driving as an unacceptable behavior while also indicating that they themselves drink and drive, including drinking while driving. Respondents supported countermeasures such as sobriety checkpoints, especially during festivals, fairs, and parades; increased access to free, safe rides; and treatment for alcoholism and alcohol abuse. Gaps in the data for Louisiana were identified. These included the perspective of offenders charged with driving under the influence (DUI) or driving while intoxicated (DWI). These gaps were addressed through an online survey of DUI/DWI offenders and structured interviews with key stakeholders. The offender survey assessed beliefs and opinions of those charged with DUI/DWI in terms of the underlying reasons people drink and drive, and potential methods for preventing this behavior. The structured interviews with stakeholders focused on the experiences, knowledge, and opinions of individuals engaged with DUI/DWI offenders. Key findings and recommendations include the need to recognize culture as a critical factor, acknowledge the problem as statewide (north-south and rural-urban), provide diverse transportation options, and recognize the critical role of education and outreach.

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Implementation Statement

Researchers conducted this study to better understand the culture of alcohol-involved driving in Louisiana, as well as develop resources to better address those high-risk behaviors to reduce crashes. The project developed an interactive mapping and data tool that enables users to identify geographic areas at highest risk of alcohol-involved driving and crashes along with cultural indicators of this high-risk behavior, benefiting both practitioners and researchers. In addition, the research produced a reader-friendly question-and-answer format literature review for determining relevant cultural groups' attitudinal and experiential differences related to alcohol; a data analysis of alcohol-involved crashes at the parish and census-block level that determined key risk factors and their locations; and a survey assessing participants' perceptions and attitudes related to drinking and driving, including potential support for various countermeasures. Finally, researchers produced recommendations to help mitigate alcohol-involved driving in Louisiana. If these recommendations are implemented, alcohol-involved driving in Louisiana could be reduced through a multi-pronged approach.

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Introduction

Though alcohol-involved driving fatalities have declined recently, alcohol-involved driving is still a severe public health problem in the United States. According to 2016 National Highway Traffic Safety Administration (NHTSA) Traffic Safety Facts, 10,497 people were killed in alcohol-involved driving crashes on U.S. roadways in 2016. Despite fewer fatalities resulting from strict enforcement of DUI laws, alcohol-involved driving fatalities (blood alcohol concentration [BAC] of .08 g/dL or higher) still accounted for more than 30 percent of Louisiana's vehicle fatalities in 2016 [1].

While interest in the investigation of crash-related factors continues, the demand for associating impaired driving problems with social and cultural factors is growing. The interaction between a person and his or her environment needs to be explored in depth. The impaired driving problem is associated with several key factors: (a) distal or situational influences, (b) proximal influences, (c) personal characteristics, and (d) behavioral aspects [2]. The first tier represents what a person defines as the social context of alcohol-involved driving. The proximal environmental tier represents the personal peer, acquaintance, and family level of the environment. Personal characteristics infer a person's view of risk related to impaired driving. The behavior or dependent variable can be the product of the interaction of factors in all the tiers. Therefore, behavioral change can be influenced by altering or modifying factors at all levels.

Culture can be described as a collective state of mind shared among members of a specific population. Louisiana is rich in culture but also culturally diverse. New Orleans and the southern part of the state are home to a large population with a French-speaking heritage entirely different from the African American and British American population living in the northern parts of Louisiana. Historically, Louisiana youth alcohol use rates have been above national rates. Based on data from the Youth Risk Behavior Surveillance System in 2017, 34.0 percent of Louisiana high school students reported current drinking, defined as "at least one drink of alcohol, on at least 1 day during the 30 days before the survey." The prevalence is notably higher than the national estimate of 29.8 percent. Although the prevalence decreased since 2013 in Louisiana and at the national level, the decrease in Louisiana was 4.6 percentage points compared to 5.1 percentage points nationally. College students also reported high alcohol use in the past 30 days, and the prevalence varied across Louisiana. In 2017, 60.9 percent of college students in the Core Alcohol and Drug Survey (CORE) reported having had "alcohol (beer, wine, liquor) in

the past 30 days." Adults also drink alcohol frequently and heavily in Louisiana. Per capita, more alcohol is sold in Louisiana than throughout the nation. In 2016, 2.56 gallons versus 2.35 gallons of alcohol per capita were sold in Louisiana and the nation, respectively. Based on data from the Behavioral Risk Factor Surveillance System (BRFSS), adults in Louisiana had a higher prevalence of heavy alcohol drinking, defined as "adult men having more than 14 drinks per week and adult women having more than 7 drinks per week" compared to the nation, which ranged from 5.9 to 6.1 percent from 2012 to 2015 [3]. In 2016, the prevalence in Louisiana equaled that of the nation, at 6.5 percent. Aggregated data for CORE and BRFSS were provided by the University of Louisiana team from the Picard Center and Center for Louisiana Studies.

Many drinking and driving arrests are made in Louisiana each year, and the number of arrests varies by parish. These arrests are not simply predicated on high population density (i.e., Orleans Parish); many low-density parishes have a disproportionately high number of drinking and driving arrests (i.e., Cameron Parish). In 2017, 630 arrests per 100,000 population were made overall in the state, but the rates varied widely from parish to parish. Similarly, the rate of fatal alcohol-related crashes per 100,000 drivers also varied across the state, with the higher rates generally in the southern part of the state, primarily below Rapides Parish. In 2017, the rate was 9.6 per 100,000 licensed drivers in the state overall, with the highest rate in the Capital Area Human Services District (14.1 per 100,000) and the lowest rate in the Jefferson Parish Human Services Authority (4.2 per 100,000). (These data must be viewed with caution considering the higher population density in the Capital Area, primarily Baton Rouge, versus the Jefferson Parish Area, ranging from Kenner to Grand Isle.) Aggregated data were provided by the University of Louisiana team from the Picard Center and Center for Louisiana Studies.

The purpose of this research was to help Louisiana Department of Transportation and Development (DOTD), Louisiana's Strategic Highway Safety Program team, highway safety stakeholders of other agencies, and law enforcement agencies better understand the individual, systemic, and system-wide influences that contribute to alcohol-involved driving. DOTD officials can target risk factors and high-risk locations to reduce alcohol-involved crashes based on study findings.

Literature Review

This section presents findings from the literature review, which confirmed several trends regarding drinking, driving, and culture. Researchers found the literature's geographic outreach to be overly general and limited in its examination of Louisiana as a definitive culture. Thus, though the literature review did provide generic cultural insight, a review of state-specific citations and crash data was needed to understand Louisiana-specific trends on the interplay between cultures, drinking, and driving.

The literature review (Task 1) sought to examine cultural differences in the context of drinking and driving, with a focus on Louisiana drivers. Applicable design entailed a critical review of the literature on drinking and driving by reviewing available citations and original articles. The research team queried Psych Info, Pub Med, Google Scholar, and Transport Research International Documentation (TRID) journal listings using multiple keywords. Articles in this analysis were primarily written in English over the last 10 years and encompassed drinking and driving, alongside culture, as a keyword option. Articles from correlational studies and observational reviews, as well as opinion papers, were reviewed. To access the nonpublished literature, the research team also reviewed 2014–2017 conference proceedings from the Southwest Psychological Association and Southeast Psychological Association, encompassing the Southeastern United States from Florida to Texas, including Arkansas and Kansas, albeit no posters or presentations were identified as meeting the noted keywords.

For the review of published articles, use of the following keywords revealed the noted number of articles: "interplay between culture, drinking, and driving" identified 66,100 articles; "culture and drinking" uncovered 2,260,000 articles; "culture and driving" returned 2,510,000 articles; "culture and driving and drinking" identified 361,000 articles; and "Louisiana and drinking and alcohol" returned 36,800 articles. Considering the vast number of identified articles, it was necessary to narrow the search and break down the review into specific areas. Culture was separated into discernible constructs, specifically age, gender, education level, income level, race, and geographic area. However, the available information was primarily based on national trends and data, with limited or no data based on Louisiana drivers exclusively. The following review of the literature is organized in the context of a set of issues and associated questions. Summary statements are also provided for each section.

Cultural Identifiers

Age Differences

The literature has predominantly examined two features pertaining to the construct of age: (a) whether persons who begin drinking at earlier ages are more likely to report drunk driving or alcohol-related crash involvement, and (b) the ages that individuals are more likely to be involved in drunk driving or alcohol-related crashes. The literature is relatively consistent regarding these questions. First, the earlier individuals begin drinking, the more likely they are to report involvement in these risky behaviors [4, 5]. Second, although different age demarcations are used in the literature, drivers from 18–23 years of age and then drivers from 32–35 years of age are more likely to drink and drive than other age groups. However, the research shows that older drivers—those over 55—are beginning to exhibit a higher frequency of drinking and driving behaviors [6, 7]. At the other end of the age spectrum, some research has shown a counterintuitive relationship between media attention and passing legislation regarding underage drinking. More media attention was associated with failing to pass more restrictive legislation in Louisiana [8].

Are drinking and driving behaviors consistent across the lifespan? National data have continually depicted a difference in alcohol use patterns between adolescents, young adults, and adults [9]. A decisive pattern has been distinguished concerning the number of days alcohol is consumed in a month and the number of beverages reported in a single setting, particularly by age groups [9, 10]. Adolescents (ages 12–20) reported drinking an average of six days in a month, young adults (ages 21–25) reported drinking an average of eight days in a month, and adults (ages 26 or older) reported drinking an average of nine days in a month. Although adolescents and young adults may have consumed alcoholic beverages on fewer days than older adults, they reported drinking more in those settings [9].

Moreover, according to Windle's study [9], adolescents averaged five drinks in a single setting, young adults averaged four drinks, and adults averaged three drinks. Thus, adolescent and young adults tended to drink alcohol less frequently than their older counterparts, but the amount that was consumed generally met the criteria for binge or heavy episodic drinking [9], usually defined as consuming at least five alcoholic beverages sequentially in two weeks [11]. Adolescents tended to drink more when the

opportunity arose (e.g., at parties) and drink more substantial amounts than young adults and older adults [9].

The major issue with adolescents engaging in more binge drinking and heavy episodic drinking is that those behaviors may result in co-occurring problems (e.g., drinking and driving or driving with someone who has been drinking) that may have adverse consequences [9]. In a longitudinal study, Zakrajsek and Shope [5] examined the driving history of participants and found that those individuals who drank at a young age were more likely to become recidivist or repetitive drunk drivers. In addition, adolescents and young adults who drank were more likely to engage in risky driving behaviors. Hingson and White [4] reported trends in risky drinking and driving behaviors throughout one's lifespan because of early onset drinking.

In summary, based on related research:

- Adolescents drink less often monthly than young adults, and young adults drink less often monthly than adults.
- While adolescents drink less often monthly, they drink more drinks in a single setting, and they have a greater propensity to binge drink. In addition, young adults binge drink more often than adults.
- Adolescents who binge drink are more likely than adolescents who do not binge drink to involve themselves in risky behaviors, such as drinking and driving, involvement in drug use, and sexual activities.
- Risky drinking and driving behaviors continue throughout a person's lifespan and are related to early onset of drinking.

Is there a difference in crash rates between the noticeably young—namely drivers less than 25 years of age—and older drivers, or drivers greater than 60 years of age? Traffic crashes represent a serious public health problem worldwide [12] and have been listed as a leading cause of death over the last four decades. As a result, age-related differences in crash rates and risk have been studied extensively [7, 13]. Although the number of crash fatalities has decreased substantially in recent years, motor vehicle crashes are still among the leading cause of death among people aged 15–29 years [14, 15]. Traditionally, it has been posited that young adult male drivers are more at risk for crashes [16] than female drivers across all ages, and all drivers older than 25 years of age.

Many studies purposefully oversampled drivers under the age of 25 and over the age of 65 because both groups have an elevated crash risk [6]. Mann and colleagues [7] investigated the risk factors associated with age groups and found that the younger age group was more likely to engage in risky behaviors. For example, they were more likely to engage in polysubstance use, such as consuming alcohol and cannabis, and then driving. Although crash involvement was lowest in the older age group, risk factors for senior citizen crashes need to be further researched [7]. One factor contributing to risky driving in the older population group was aggressive driving [13]. Mann and colleagues [7] also demonstrated that some risk factors for crash rates or risk do not change as someone ages, with aggressive drivers displaying the same behaviors from their youth to their senior adulthood.

In summary:

- Though the total number of crashes decreased over the last decade, motor vehicle crashes remain among the leading causes of death in people aged 15–29.
- Younger persons tend to engage in riskier behaviors than older persons, including riskier driving behaviors.
- Risky driving behaviors continue across a person's lifespan—including into older years.

Does the age of initial drinking affect alcohol consumption? The initiation of drinking at an early age is correlated with alcohol dependence and alcohol-related problems later in life, including ongoing alcoholic episodes [17]. Traditionally, mental health disorders, including substance abuse and addiction-based disorders are initially demonstrated and/or revealed by the age of 25 years [18]. A factor that has been considered when analyzing the age of drinking onset is the delay to first intoxication [19]. When the ages of onset drinking and first intoxication were considered, students who experienced drunkenness first were more likely to engage in hazardous drinking [19]. However, some studies have shown contradicting information. Rossow and Kuntsche [20] found that early onset drinking behaviors was not strongly correlated with heavy drinking behaviors in adulthood unless the participant also exhibited other problem behaviors. Another study supported a link between one's age at first alcoholic drink consumption and subsequent adult drinking-related problems, but not strongly [21]. Thus, although most policy makers have focused on delaying the initiation of drinking as a mechanism of delaying alcohol problems, more research is needed to clarify the relationship [21]. Both age of first

consumption and age of first intoxication must be considered as different, not synonymous, constructs.

In summary:

- An early age of onset drinking is associated with alcohol-related problems later in life.
- Most cases of mental and substance use disorders develop by the age of 25.
- Age at first alcoholic drink versus age at first intoxication may cause different problematic behaviors.
- Overall, most studies conclude that delaying the initiation of drinking may delay alcohol-related problems.

Religious Differences

Religiosity or spirituality serves as a protective factor against many health problems, including but not limited to alcohol use problems. Both young adults and adults are more likely to restrict their use of alcohol or drugs if they have a religious affiliation [22, 23]. Early exposure results in a higher likelihood of alcohol use disorders [17], though young adults who are religious/spiritual are less likely to abuse alcohol [22]. Regardless of specific religious affiliation, people are less likely to engage in risky behaviors (i.e., drinking and driving) if they are actively religious and/or spiritual [24]. Although most religions negate a person's excessive use of drugs or alcohol, certain religions are more accepting of alcohol use. Legislation introduced in the past few decades may have played a role in reduced drinking and driving related incidents, specifically the increase in the drinking age from 18 to 21 across several states [25, 26], and religion has historically influenced the passage of this type of prohibitive legislation, as evidenced by regional variation in laws alongside regional variation in religious preferences.

Are there geographic differences attributed to religiosity variations in the likelihood of individuals to engage in first exposure to alcohol? Across the United States, there are pockets of religious affiliations, with the same pattern in Louisiana. In Louisiana, citizens in the northern part of the state are generally members of Protestant denominations, such as Baptist and Methodist. Conversely, in the southern part of the state, citizens are usually Catholic. Historically, Catholics overall are more tolerant and accepting of drinking. No studies have linked or examined the relationship between drinking and religion specifically within Louisiana. Based on these realities, a general

assumption can be made that individuals in southern Louisiana are more likely to be Catholic. Due to this religious affiliation, acceptance of drinking behavior may be tolerated more in southern Louisiana than in northern Louisiana.

A study involving college students in the “buckle” of the Bible Belt noted that they had more religiosity and spirituality and reported fewer unhealthy drinking behaviors than students from southern universities bordering the Bible Belt [22]. However, almost one-third of students in the study reported driving a vehicle after drinking.

Another study focused on the influence of binge drinking by considering the role that religion and region play. The researchers found that regional constraints influenced by the dominant religion also affect binge drinking by adherents of minority religions [23]. The study found that blanket prohibitions on drinking, whether explicit (with dry counties) or implicit (by low access to liquor stores or via religious teaching in counties influenced by Baptist beliefs regarding alcohol consumption), may cause individuals to binge drink less regardless of their effect on drinking in general. While religious beliefs help shape regional cultures (and constraints), the study showed that individuals belonging to minority religions (such as Catholics in the south or Baptists in the north, midwest, and west) conformed to the region in which they reside. The context of region appeared to play a more important role than religion does on binge drinking. Results suggested that Catholics in the south were less likely to binge drink and that Baptists in the other three regions were more likely to binge drink. Regarding crashes, Stringer [24] found that anti-alcohol religious affiliation was related to a decrease in alcohol-related crashes. In the study, increases in factors associated with anti-alcohol community norms, values, attitudes, and beliefs were related to decreases in alcohol-related crashes at the county level. Measures associated with pro-alcohol factors were related to increased alcohol-related crashes.

In summary:

- Religion is one of the regional and cultural factors influencing attitudes toward drinking and associated behaviors.
- The regional context, including the dominant religion, may play a larger role on binge drinking behavior than religion alone.
- Counties with the presence of anti-alcohol religions show decreases in alcohol-related crashes.

Racial/Ethnic Differences

The literature has extensively studied ethnic differences related to driving while intoxicated (DWI) or driving under the influence (DUI) in attitudes and norms related to ethnic variations. Ethnic minorities are more likely to be charged with alcohol-related driving offenses than non-Hispanic and non-African American drivers. Research has consistently questioned whether high incidences of DUI within these subgroups are related to cultural differences and attitudes toward drinking or simply cultural profiling. Subsequently, profiling results in the increased likelihood that selected subgroups have a higher probability to be pulled over for DUI offenses [27].

It is important to define the difference between race and ethnicity, particularly in the context of the present literature review. Race is defined as a person's physical characteristics, such as bone structure and skin, hair, or eye color, while ethnicity is defined in the framework of cultural factors, including nationality, regional culture, ancestry, and language.

Are there race/ethnic differences in the likelihood of individuals to engage in first exposure to alcohol? Most studies show little variation between race and age at onset of alcohol use [28]. Sartor and colleagues [29] compared African American and European American youth and noted that African Americans had earlier ages of onset alcohol consumption compared to European Americans. However, the timing of initiation to an alcohol use disorder was consistent across races/ethnicities [29]. On the contrary, another study found that European Americans had earlier ages of first alcohol exposure, while African Americans had an earlier onset of alcohol problems [30]. Jackson [31] found no race difference in the age of initial drinking or frequency of alcohol intake. However, European Americans' progression of drinking events was more accelerated compared to other races/ethnicities [31]. Overall, the literature on the effects of race on the age of onset drinking and lifetime consequences is inconclusive.

In summary:

- Racial/ethnic differences regarding first exposure to alcohol are contradictory.
- Timing of developing an alcohol use disorder is typically lower among African Americans.
- Traditionally, European Americans engage in drinking earlier than African Americans.

Are there race/ethnic differences in reported crashes? A few studies have depicted race/ethnicity as a persistent risk factor for DUI among young adults [32]. Delcher and colleagues [32] conducted a longitudinal study to examine racial/ethnic differences among adolescents who consume alcohol. The study supported the researchers' hypothesis that the likelihood of attaining a DUI was higher among Whites, followed by Hispanics, Asians, and Blacks, across all the models. A contributing factor may have been that Whites, Hispanics, and Asians had easier access to alcohol within the home [32]. For Whites and Blacks, monthly drinking frequency and binge drinking in early adolescence were associated with the attainment of DUIs in adulthood. A factor to consider is the likelihood of self-reporting based on race. Romano and colleagues [27] found that the rates for self-reported DUIs were lower among Blacks and Hispanics compared to Whites. Caetano and McGrath [33] also found higher rates of self-reported DUIs among Whites than Blacks. Although Whites reported more DUIs, Hilton [34] found that Native Americans and Hispanics had higher rates of drinking and driving fatalities. Future research can benefit from including more non-White respondents and using tools other than self-reported measures.

To summarize:

- Difficulty defining and measuring race/ethnicity complicates understanding its association with drinking and crashes.
- A limitation of reviewed studies is that most studies involved self-report tools, and most participants completing them self-identified as White.
- Self-reported DUI rates are higher among White Americans. However, Native Americans and Hispanics have higher rates of drinking and driving fatalities.
- Across all studies, American Indians and Asians are underrepresented.

Gender Differences

Across all studies, a consistent gender-related pattern is found; namely, men are more likely to be involved in alcohol-related risky behaviors, specifically drinking and driving. When compared across ethnic groups, these gender patterns continue. Gender differences have been attributed to many psychological phenomena, including intelligence, sequencing, and memory, alongside mental health issues, such as depression, anxiety, and alcohol abuse/misuse disorders. Logic dictates that gender differences are not only found related to alcohol use and propensity, but also in the probability to concurrently drink and

drive. The following information addresses multiple questions specifically pertaining to gender differences and drinking and driving. Again, gender refers to biological identification.

What is the current knowledge about gender differences in relation to risky behaviors? Generalizing predictive factors across all types of risky driving is problematic. Different factors predict different risky driving behaviors [35]. Rhodes and Pivik [36] analyzed the influence of positive affect and risk perception by age and gender. As an example, the positive affect (predilection for risky driving behaviors) predicted more risky driving in males than females. However, Fernandes and colleagues [35] found that behaviors initially predicted by gender were superseded by personality traits or general attitudes. Specifically, sensation seeking was identified as one of the most common causes of risky driving in males [35]. The relationship between sensation seeking and risky driving was further examined by Jonah and colleagues [37]. They utilized both males and females in their study to determine if gender played a moderating role. Most research on sensation seeking behaviors up to this study involved primarily males. As such, in Jonah et al.'s study, there was not a significant interaction between sensation seeking, risky driving, and gender. Regarding gender roles, risky driving, and crash risk, Ivers and colleagues' [38] study involving novice drivers found that regardless of gender, those who reported higher levels of risky behaviors had an increased risk of crashing.

In summary:

- Personality traits and general attitudes supersede the gender predictor.
- Sensation seeking is one of the most common causes of risky driving.
- Regardless of gender roles, those who engage in higher levels of risky behaviors have an increased likelihood of crashing.

Is the assumption that males drive more often than females strictly a cultural proposition? Does the current vehicle miles traveled (VMT) support this proposition? A previous study showed that females experience fewer fatalities than males [39]. Historically, males drive more vehicle miles per year than females [39], though there has been an increase of females in the workforce [40] since 1975. In addition to females being a prominent part of the workforce, most have also continued to retain their family obligations [41]. Thus, the VMT per year has increased for females relative to the VMT of males. Moreover, traffic fatality rates have decreased in recent

years, though it is unclear if female drivers are responsible for part of the decline in overall traffic fatalities [39]. Limited research has investigated VMT by both males and females from a cultural practice perspective.

In summary:

- Since 1975, VMT has increased more for females than males.
- The raw number of fatalities due to crashes is lower among females than males.
- Since females increased their driving, a decrease in traffic fatality rates has occurred, but it is unclear to what extent females account for the decline.

Socioeconomic Status

The relationship between socioeconomic status and driving after drinking is complex and not well understood. Analyses based on the 2012 BRFSS data and the 2001–2002 National Epidemiologic Survey on Alcohol and Related Conditions illustrated associations between higher income levels and higher self-reported alcohol-involved driving [42, 43].

How does binge drinking relate to socioeconomic status? BRFSS data from 2006 suggested that binge drinking was more strongly associated with alcohol-involved driving than income level. In this analysis, the association between increased binge drinking and alcohol-involved driving was elevated across all levels of income [44]. Consequently, discussion of binge drinking and related factors is included in prior sections.

In summary:

- The relationship between socioeconomic status and driving after drinking is complex and likely multifactorial but not entirely understood.
- Binge drinking may be a stronger indicator of alcohol-involved driving than income level.

Military

Within Louisiana, there is a considerable military presence, with the Barksdale Airforce Base in Bossier City, the Fort Polk Army Base near Leesville, and Camp Beauregard, an Army National Guard installation, near Pineville. In addition, a large military presence exists in the New Orleans area, including the Naval Air Station Joint Reserve Base,

Marine Corps Support Facility, and Naval Joint Reserve Base. The following descriptions focus on the interplay between military personnel and drinking and driving. A vast amount of literature on the military population and drinking and driving does not exist, perhaps due to the difficulty in attaining statistics for this population. The military population can be divided into many groups, such as active-duty military personnel, veterans, enlisted members, and commissioned officers. For military research, it is important to consider the military culture, comradery, acceptance of risky behaviors, and military policies. While the literature has extensively examined drug and alcohol use in the military, it has not widely studied driving coupled with drinking behaviors in military personnel. Following is a limited review of this available research.

Is unsafe driving in veterans comorbid with psychological disorders? It would be reasonable to assume that unsafe driving would be comorbid with other mental health conditions, such as depression and anxiety, in the veteran population, similar to the general population. However, limited studies exist on this topic. In the sole article on this issue, a study by Kuhn and colleagues [45] determined that male veterans with post-traumatic stress disorder (PTSD) were associated with more aggressive driving than other veterans without PTSD.

Is unsafe driving more prevalent following recent deployments? One study reported that Afghanistan and Iraq veterans engaged in more acts of aggressive driving than other veterans [45]. Another study found that service members returning home from combat deployments were more likely to have recently engaged in risky driving behaviors [46]. Overall, there were notable gaps in the literature regarding this subject.

In summary:

- There are four military bases in Louisiana. The military presence in Louisiana is important to note due to the differences in the military culture/lifestyle from the general population.
- For male veterans, mental health disorders are associated with aggressive driving.
- Veterans or active-duty members who have experienced combat are more likely to engage in risky driving behaviors.

Geographic Variation

Louisiana is separated by many cultural variables, including geographic variances. A review of the literature was completed to determine if any studies had specifically compared the geographic cultures of Louisiana, such as Protestant North and Catholic South, or made comparisons based on race alongside other variables. Specific reviews are presented in the following narratives.

Are individuals more likely to drink and drive during festival times? Festivals are a unique part of the Louisiana culture, and alcohol is typically present at those events. Examples of key events, in addition to Mardi Gras, and their cities are listed in Table 1.

Table 1. Festivals by city

Festival	City
Ponchatoula Strawberry Festival	Ponchatoula
Festival International	Lafayette
French Quarter Festival	New Orleans
Crawfish Festival	Breaux Bridge
Rice Festival	Crowley
Bogalusa Blues and Heritage	Bogalusa
French Food Festival	Larose
Catfish Festival	Winnsboro
Baton Rouge Blues Festival	Baton Rouge
Voodoo Music and Art Experience	New Orleans
Essence Festival	New Orleans
Jambalaya Festival	Gonzales
Contraband Days	Lake Charles
Rayne Frog Festival	Rayne
Shrimp and Petroleum Festival	Morgan City
Zwolle Tamale Festival	Zwolle
Mudbug Madness	Shreveport
Peach Festival	Ruston
Alex River Fete	Alexandria

The literature has not fully examined whether festivals influence the frequency of drinking and driving and associated crashes. Economic literature discusses the impact of festivals on the local economy. Sociology and anthropology literature focuses on how festivals affect social cohesion. In summary, although there is abundant research based on an economic and social standpoint, studies have not examined Louisiana and drinking and driving in the context of festivals and their respective dates.

Are there differences in substance use patterns across individual parishes? A review of the research suggests that few, if any, studies have examined Louisiana culture specifically regarding the propensity of drinking and driving. However, a review of the Louisiana Annual Health Report Card from March 2018 suggests that several parishes have a disproportionate number of deaths associated with chronic liver disease and cirrhosis [47] as well as higher numbers of crashes, based on Louisiana crash records. Thirteen parishes with particularly unique characteristics are discussed in the following narratives. The primary sources for this information are the People and Places website offered through the Center for Louisiana Studies at the University of Louisiana at Lafayette [48], the Louisiana Department of Health, and the Picard Center.

Bossier Parish. Bossier Parish is in the northwest part of the state and adjoins Caddo Parish. The major industry in the northern part of the parish is forestry, and the major industry in the central part is gambling or riverboats. Over the last 20 years, the parish has undergone major infrastructure and educational reforms, mainly due to residential flight from Caddo Parish. Although regulations are more consistent now than 20 years ago, Caddo Parish used to not allow sales of alcohol on Sunday, whereas Bossier Parish did; thus, many Caddo Parish residents would cross parish lines to purchase alcohol. In addition, Bossier Parish has the only horse racing track in North Louisiana.

During 2013–2016, 64 deaths attributed to chronic liver disease occurred. Many youth-based descriptors are also important to observe. In this parish, 8.02 percent of youth in the 12th grade were suspended from school in 2016. In 2010, 36.53 percent of 6th graders and 68.57 percent of 12th graders acknowledged drinking alcohol at home without their parents' permission.

Lincoln Parish. Lincoln Parish is very diverse, with both a large wealthy population and a large population with meager financial resources. Largely a woodland parish, the economy of Lincoln depends on the forestry industry and the manufacture of wood. There is little industry beyond forestry and Louisiana Tech University. The university is the largest employer. During 2013–2016, 15 deaths attributed to chronic liver disease occurred. Many youth-based descriptors are also important to observe. In this parish, 0 percent of youth in the 12th grade were suspended from school in 2016. In 2010, 47.36 percent of 6th graders and 60.64 percent of 12th graders acknowledged drinking alcohol at home without their parents' permission.

Grant Parish. Known as one of the Reconstruction parishes, Grant Parish is north of Alexandria and south of Ruston. It has a considerable racial divide and a long history of

racial tension dating prior to the Civil War. Grant has been home to a thriving economy based on agriculture and forestry. Principal crops include corn, hay, and oats. Its topography includes hills, streams, lakes, flatlands, farmland, fields, small towns, rivers, and piney woods. The parish has no traffic signals. Only blinking caution and intersection lights are present in this rural parish. It is very rural, and the main industry is forestry. It is in the central part of the state. Economically, it is depressed and has a large minority population. During 2013–2016, nine deaths occurred that were attributed to chronic liver disease. However, this is not a densely populated parish. Many youth-based descriptors are also important to observe. In this parish, 12 percent of youth in the 12th grade were suspended from school in 2016. In 2010, 76.47 percent of 6th graders and 53.85 percent of 12th graders acknowledged drinking alcohol at home without their parents' permission.

Allen Parish. Allen Parish is often called the gateway to Southwest Louisiana. Oberlin, Louisiana, is the Allen Parish seat. The population is estimated to be 24,000, and Oakdale is the largest municipality. The large rural community is known for farming, hunting, fishing, and canoeing. It has thousands of acres on which rice and crawfish are cultivated and extensive timberlands, some 367,000 acres. The parish's economy is based on forestry, livestock, agriculture, and a large federal detention facility. It is very impoverished, and forestry is the main industry. Allen Parish is also the home of the Coushatta Indian tribe, known as the "Red Shoes People," and the Coushatta Casino Resort.

During 2013–2016, nine deaths attributed to chronic liver disease occurred. Many youth-based descriptors are also important to observe. In this parish, 12.27 percent of youth in the 12th grade were suspended from school in 2016. In 2010, 43.48 percent of 6th graders and 50.70 percent of 12th graders acknowledged drinking alcohol at home without their parents' permission.

Sabine Parish. Historically, Sabine Parish has a long history of independence and efforts to disavow itself from the establishment of government. Due to boundary disputes with its origin, it became a demilitarized territory in the early 1800s, becoming a home for outlaws, criminals, and desperados. Present-day Sabine Parish, with over 22,600 residents, has an economy based on cattle, poultry, and the manufacture of wood products. Sabine Parish is popularly called Toledo Bend Country because of its 186,000-acre manmade reservoir teeming with bass, bream, crappie, and catfish. During 2013–2016, nine deaths were attributed to chronic liver disease. Many youth-based descriptors are also important to observe. In this parish, 7.88 percent of youth in the 12th grade were

suspended from school in 2016. In 2010, 57.69 percent of 6th graders and 47.69 percent of 12th graders acknowledged drinking alcohol at home without their parents' permission.

Cameron Parish. Cameron Parish is in the southwest corner of the state. It is primarily marshland. Main industries in the parish include fishing, petroleum, and agriculture. Cameron Parish's principal tourist attraction consists of the Creole Nature Trail National Scenic Byway. The first national byway in the South on the Gulf of Mexico, this 180-mile-long trail traverses the Louisiana coastal marsh. The byway provides the greatest access to Louisiana's beautiful and distinctive coastal marshlands. Like the Florida Everglades, the wetlands along the byway are carpeted with gorgeous verdure. Marinas, fishing and crabbing venues, bird watching, boat launches, and lodging are available in the wetlands area. From 2013–2016, the number of deaths attributed to chronic liver disease was too small to report. Many youth-based descriptors are also important to observe. In this parish, 0 percent of youth in the 12th grade were suspended from school in 2016. This figure is probably due to a lack of reporting and holds no true statistical relevance. In 2010, 28.57 percent of 6th graders and 50 percent of 12th graders acknowledged drinking alcohol at home without their parents' permission.

Plaquemines Parish. Plaquemines Parish is a peninsula bordered by the Gulf of Mexico and parallel to the Mississippi River. With 1,584 square miles of water and nearly two-thirds of the land designated as coastal marsh, the parish contains approximately 10 percent of the United States' wetlands. Today, the parish boasts a population of over 25,000 individuals from Acadian, Creole, German, Spanish, Vietnamese, Filipino, and Croatian pedigree. Plaquemines Parish's economy is based on oil, gas, sulfur, citrus crops, and seafood production. For seafood production alone, over 60 million dollars of products are exported internationally. Some of the seafood includes oysters, shrimp, crawfish, and crabs.

During 2013–2016, nine deaths were attributed to chronic liver disease. Many youth-based descriptors are also important to observe. In this parish, 16.84 percent of youth in the 12th grade were suspended from school in 2016. In 2010, 31.25 percent of 6th graders and 60.47 percent of 12th graders acknowledged drinking alcohol at home without their parents' permission.

St. Bernard Parish. St. Bernard Parish is one of Louisiana's original 19 parishes. Today, St. Bernard, with a population slightly over 66,600, receives substantial revenues from the truck farming industry, oil and gas production, commercial fishing, and trapping. It

suffered horribly during Hurricane Katrina, with as much as 7 feet of water in many parts of the parish. With 1,328 square miles of wetlands, St. Bernard Parish is also an ideal spot for recreational fishing. During 2013–2016, 28 deaths were attributed to chronic liver disease. Most youth-based descriptors are unavailable for this parish.

Orleans Parish. Orleans Parish is between the south shore of Lake Pontchartrain and the Mississippi River, with access to the Port of New Orleans and major railways and near the Louis Armstrong New Orleans International Airport. With an established and widening industrial base—including stalwarts such as energy, trade, and advanced manufacturing, as well as emerging strengths like film and digital media—the parish has significant resources and participation invested by both public and private organizations. During 2013–2016, 189 deaths attributed to chronic liver disease occurred. Many youth-based descriptors are also important to observe. In 2010, 66.67 percent of 6th graders and 45.61 percent of 12th graders acknowledged drinking alcohol at home without their parents' permission.

Livingston Parish. The bulk of Livingston Parish's revenues still come from the forestry industry. Until the completion of a railroad system in 1908, the nearby waterways of the Amite, Tickfaw, and Natalbany Rivers were used as highways for shipment of their products, including millions of feet of lumber. With the decline of sawmills in the 20th century, many of the once thriving railroad communities have reverted to small villages. The geographic foundation is marsh and forest. During 2013–2016, there were 70 deaths attributed to chronic liver disease. In 2010, 37.70 percent of 6th graders and 57.92 percent of 12th graders acknowledged drinking alcohol at home without their parents' permission.

Ascension Parish. Located along the Mississippi River in an area historically known as the Acadian Coast, Ascension Parish was one of the original parishes created by the territorial government in 1807. Today, agriculture and the petrochemical industry constitute the foundations of the local economy. Divided by the Mississippi River, Ascension Parish's two major geographical components have very different demographic and economic profiles. These differences are mirrored in the parish's eastern and western centers—Gonzales and Donaldsonville. During 2013–2016, 29 deaths were attributed to chronic liver disease. Many youth-based descriptors are also important to observe. In 2010, 47.76 percent of 6th graders and 56.63 percent of 12th graders acknowledged drinking alcohol at home without their parents' permission.

Terrebonne Parish. Although thousands of acres of sugarcane still exist across the parish, the economy of Terrebonne has been inextricably tied to the petroleum industry since the discovery of oil in the parish in 1929. In addition to sugarcane and oil and gas production, present-day Terrebonne Parish also receives revenues from the commercial fishing industry. Visitors enjoy the swamp scenery, especially the alligators, nutria, and varieties of birds in the wild. Other attractions include art galleries; guided boat, land, and air tours through the swamps; seafood processing plants; Cajun food, music, and culture; and Houma's Native American communities. While in Houma, popularly called the Venice of Louisiana, tourists might also travel across the city's seven bayous and 55 bridges. During 2013–2016, 61 deaths were attributed to chronic liver disease. Many youth-based descriptors are also important to observe. In 2010, 31.18 percent of 6th graders and 47.23 percent of 12th graders acknowledged drinking alcohol at home without their parents' permission.

Lafayette Parish. In the heart of Cajun country lies Lafayette Parish, one of South Louisiana's most popular tourist destinations. Most of Lafayette Parish's 259 square miles comprise prairies, although there are alluvial plains. Although the parish is the third smallest in the state, it has a population of nearly 200,000 and is a center for the state's oil and gas industry. From 2013–2016, 68 deaths were attributed to chronic liver disease. Many youth-based descriptors are also important to observe. In this parish, 8.98 percent of youth in the 12th grade were suspended from school in 2016. In 2010, 30.47 percent of 6th graders and 55.04 percent of 12th graders acknowledged drinking alcohol at home without their parents' permission.

In summary:

- Some parishes have notable historic, geographic, economic, and other factors that may influence drinking and driving behaviors.
- Variation in chronic liver disease occurs across parishes.
- Negative drug- and alcohol-related identifiers are spread out across the state, with few limited to specific geographic areas.

Alcohol Availability and Alcohol Outlet Density

Louisiana has long debated whether alcohol availability and alcohol outlet density promote drinking. From the 1940s to the mid-1980s, the state utilized Blue Laws to

curtail the purchase of alcohol for religious, cultural, and later economic reasons. While intended to curtail purchase and consumption of alcohol on Sundays, Blue Laws simply prompted individuals to purchase alcohol from neighboring states (i.e., Texas on the western side of the state) or adjoining parishes (i.e., persons from Caddo Parish would travel to Bossier Parish to purchase alcohol on Sundays since Bossier City did not have Sunday bans on the sale of alcohol). More broadly, alcohol availability/alcohol outlet density has been actively studied recently [49, 50]. Basic logic suggests that increased alcohol availability in terms of number of opportunities (analogous to exposure) and greater convenience (in terms of distance, a surrogate for travel time) will increase consumption. This general logic was acknowledged by Ponicki et al. [51] in their study of outlet density and crashes, though Gmel et al. [49] failed to identify causal direction between demand and supply. Thus, this relationship may not be as straightforward as it initially seems. Demonstrating a statistically significant linkage between increases in availability/outlet density and consumption is challenging and sometimes not discernable [52].

Key Issues and Alcohol Availability

How does local geography impact the effect of alcohol availability? Local geography can be a determining factor on alcohol availability. One study [53] found a linkage between outlet density and alcohol consumption for southern Louisiana, but not for Los Angeles County after controlling for demographic factors. The authors suggested that while aggregate density may be the same between the two areas, the physical design of Louisiana neighborhoods, along with the associated travel patterns, may be sufficiently different to yield different exposures to outlets and different levels of consumption.

How does alcohol availability affect crash frequency? Assuming a demonstration of increased alcohol consumption, the linkage between consumption and crashes is even more complex. Although it is generally acknowledged that, all else being equal, increased consumption will lead to increased crashes, the type of outlet makes a difference [49]. On-sale outlets provide for the consumption of alcohol on site, while off-sale outlets require the consumption away from the purchase site. This complication is alluded to by Grunewald [54] in his study on regulating alcohol availability. It is explicitly called out by Ponicki et al. [51] in their study of crashes in California and by Han et al. [52] in their study of off-sale outlets in Lubbock, Texas. For example, off-sale outlets may actually decrease the risk of crashes even though the aggregate outlet density for an area may increase, which makes consideration of specific local conditions essential to gain an

accurate understanding of the likely impact of alcohol availability on consumption and crashes, as well as on potential countermeasures [52]. Local conditions include geography/spatial layout, travel patterns, and historical aspects, such as drinking traditions/culture and the prior existence or lack of outlets.

In summary:

- The linkage between outlet density and consumption is complex and multidimensional. Consideration of specific local conditions is essential to an accurate understanding of the likely impact of alcohol availability on consumption and crashes, as well as on potential countermeasures.
- The linkage between increased consumption of alcohol and crashes is even more complicated and is highly dependent upon the type of outlet (on sale versus off sale). This effect is potentially powerful enough to produce counterintuitive results.

Trip Planning and Ride Sharing

Transportation network companies (TNCs) are a relatively new transportation mode, often called ride hailing. Essentially, riders use apps on their cell phones or other digital technology to request rides from drivers operating their privately owned vehicle. The largest TNCs in the United States are Uber and Lyft, both of which have a presence in Louisiana. Because of their relative ease of use and large market share, TNCs have the potential to be a successful countermeasure against driving after drinking [55]. The culture of trip planning is related to using TNCs when individuals know that they will be drinking alcohol away from their home or place of residence. Trip planning involves several steps. The planning may take place at several stages, such as before drinking or arriving at a party or bar, while drinking, or after drinking. TNCs may be attractive to riders since they can be easier to hail than a taxi and faster to locate than a bus. Potential exists for many lives to be saved if more individuals intentionally plan their trip to their destination after drinking by using a mode other than their own vehicle.

Culture of TNC Use and Impact of Crash Frequency

Who, as determined by cultural differences, is most and least likely to use TNCs?
Based on a recent survey conducted by Jiang [56], the use of TNCs in the United States has rapidly increased, more than doubling from 15 percent in 2015 to 36 percent in 2018. Usage varied by age, education, and income.

Key findings from the survey include the following:

- 51 percent of respondents 18–29 years old had used a ride hailing service compared to 24 percent of respondents 50 years and older.
- 53 percent of respondents with an annual household income of $75,000 or more had used a ride hailing service compared to 24 percent of respondents with an annual household income of less than $30,000.
- 55 percent of respondents with a bachelor's or advanced degree had used a ride hailing service compared to 20 percent of respondents with less than or equal to a high school diploma.
- In urban areas, 55 percent of respondents ages 18–29, 70 percent of respondents with a college degree or greater, and 71 percent of respondents with a household income of $75,000 or more had used a ride hailing service versus 36 percent, 32 percent, and 32 percent of respondents in rural areas, respectively.

These trends are logically consistent and describe real-world conditions. Individuals earning greater than $75,000 annually are more likely to have both expendable income and access to credit cards, giving them opportunities to go out more and then use their credit cards to access TNCs. Citizens with higher education usually have higher incomes. Younger populations are more likely to understand and use technology than older populations [57]. Older individuals may also be hesitant to allow strangers to give them a ride. Finally, regarding rural versus urban status, TNCs do not cover rural areas and urban areas—as in Louisiana, where services are only available in five to six cities [58, 59].

In 2015, the Texas A&M Transportation Institute conducted a pilot study to better understand the relationships between trip planning, drinking behaviors, and driving after drinking in Texas cities [55]. Participants indicated that they supported using TNCs to avoid driving after drinking and would pay between $10 to "any price" to use a TNC after drinking. One stated benefit of TNCs was convenience. Barriers to their use included surge pricing during peak demand times, having to leave a personal vehicle at a bar or other location, and social context. Recommendations for increasing the use of TNCs to prevent crashes included promotional pricing, other incentive programs, and partnerships with drinking establishments [55].

Do TNCs reduce driving after drinking and associated crashes? A handful of studies have examined whether using TNCs decreases impaired driving and crashes [50, 60, 61, 62, 63]. The results of these studies are mixed. Peck [62] found a 25–35 percent decrease

in the rate of alcohol-related crashes in New York. However, Brazil and Kirk [60] found no impact from the entry of Uber into metropolitan counties across the United States on the frequency of traffic fatalities overall or frequency specific to drunk driving. Morrison et al. investigated the impact on crash and injury frequency in four cities where Uber entered the market, temporarily suspended services, and resumed services. The researchers reported that alcohol-related crashes decreased after Uber resumed service in Portland, Oregon, and San Antonio, Texas, but not in Reno or Las Vegas, Nevada. Further, resumption of services was not associated with a decrease in injury crashes in the four cities. Evaluating this complex issue is difficult. Only studies using secondary data sources are available. These studies are limited because they cannot account for potential confounding factors and unidentified contributing factors.

In summary:

- Use of TNCs in rural areas in Louisiana may be limited since these services are only available, depending on the TNC, in five or six cities.
- Adequately evaluating the impact of TNCs on the frequency of driving after drinking and subsequent crashes is complex. Available studies offer mixed results. Positive studies provide compelling evidence that TNCs may be an effective countermeasure.
- It could be beneficial from a prevention standpoint to examine the correlation between the entry of TNCs into the Louisiana market and the frequency of arrests and crashes associated with drinking and driving. An additional research gap is understanding the culture of trip planning in Louisiana.

Literature Review Summary

The literature review identified sources related to culture and driving after drinking. The methodology included an examination of the published and unpublished research by searching various databases. Databases accessed included Psych Info, Pub Med, Google Scholar, and TRID. Over 66,100 articles were identified. From this group, approximately 60 articles were deemed relevant and reviewed. To establish an organizational framework, cultural identifiers were recognized, and research questions were presented. The literature review was organized in the context of a set of issues and associated questions. Summary statements were also provided for each section.

Age influences risk taking, and risk taking is strongly associated with driving after drinking and the related risks of DUI. Adolescents are inherently prone to risk-taking behaviors including binge drinking. Furthermore, risk-taking behaviors, including drinking and driving, are related to the early onset of drinking. The patterns established early continue throughout one's life. Religion varies by region and influences attitudes toward drinking and associated behaviors, including the propensity to take risks. Religion also influences the propensity toward binge drinking, though the regional cultural context may play a larger role in binge drinking behavior than religion alone. However, counties with a presence of anti-alcohol religions typically have fewer alcohol-related crashes.

Race and ethnicity are factors affecting alcohol use and associated behaviors. However, racial, and ethnic differences regarding first exposure to alcohol are not well defined or consistent across studies. Certain associations are observed, but the underlying causes remain unclear, and the associations vary across studies. Difficulty measuring race and ethnicity complicates understanding their associations with drinking and crashes.

Generalizing predictive factors across all types of risky driving is problematic. Different factors predict different risky driving behaviors. This element is especially true for gender differences. Personality traits and general attitudes are more important than gender as a predictor of risky driving behaviors, including driving after drinking. Regardless of gender, individuals who engage in risky behaviors are more likely to crash.

The relationship between trip planning using TNCs and DUI and associated crashes is ambiguous at the national level in general and for Louisiana specifically. Promising associations between various cultural influences and the use of TNCs have been identified; however, causality remains unclear. The use of TNCs is widely recognized as a function of multiple factors, primarily age and income. Louisiana's inherently rich and diverse cultural heritage makes this relationship even more complex.

Regarding alcohol availability and outlet density, the link between outlet density and consumption is complex and multidimensional. Consideration of local conditions is critical to accurately understand the impact of alcohol availability on consumption and crashes, as well as on potential countermeasures. The linkage between increased consumption and crashes is even more complex and is highly dependent upon the type of outlet (on sale versus off sale). This effect is potentially sufficiently powerful enough to produce counterintuitive results (e.g., increased density associated with reduced crashes).

Overall, little literature focuses specifically on these issues in Louisiana. Prevention efforts in Louisiana will be better informed with data on the frequency of impaired driving and resulting crashes and contributing factors within a cultural context. Gaps in understanding can be filled by analyzing alcohol-related crashes in Louisiana and factors such as age, gender, ethnicity, religion, income level, risk-taking behaviors, trip planning, TNC availability and use, and alcohol availability.

Objective

The overall objective of this research was to identify individual, community, and influential cultural factors that contribute to alcohol-involved driving in Louisiana. The specific project objectives were to:

1. Synthesize and document existing resources for assessing alcohol-involved driving.
2. Identify individual, community, and cultural influences contributing to alcohol-involved driving in Louisiana.
3. Develop a final detailed report and an interactive web tool for systemic risk assessment.

Scope

Project Overview

The scope of this project was to address the alcohol-involved driving problem in Louisiana through a systemic analysis conducted with traffic crash data and demographic data. The analysis is available via an interactive web tool. This project also included survey data collected from both Louisiana residents and DUI/DWI offenders, as well as information collected through structured interviews with key stakeholders.

During the course of this project, researchers determined that "alcohol-involved" was a more accurate data source descriptor than "alcohol-impaired," as listed in the project title. The phrase "alcohol-impaired" has legal ramifications and implies that drivers were over the legal limit in terms of their blood alcohol level. Therefore, for this project, the phrase "alcohol-involved" was adopted. Alcohol-involved refers to cases where a police officer identified on a crash report that a driver had consumed alcohol prior to or while driving or that such consumption contributed to a crash, without limitations on the amount of alcohol detected in blood or breath. The Methodology section provides a detailed list of the specific variables used to identify alcohol-involved crashes.

Project Tasks

This project included six tasks, as briefly described below. The occurrence of the coronavirus (COVID-19) pandemic required modification of some of the project activities given the inability to collect data in person.

Task 1: Review of Literature and Data Systems

Task 1 included a literature review to guide Tasks 2, 3, and 5 as well as a review of available data systems for Task 2. Researchers reviewed a variety of sources located via internet and database searches for peer-reviewed articles and published reports. Crash, injury surveillance and health, roadway inventory, citation, census, and geographic information system (GIS) data were reviewed and included in subsequent data analyses and the web tool for systemic assessment.

Task 2: Identify Risk Factors Using a Systemic Approach

Task 2 identified risk factors, including behavioral factors, associated with alcohol-involved driving and crashes using a systemic approach. Traditional approaches for identifying crash contributing factors and selecting countermeasures are mainly based on hotspot identification, which does not consider factors such as vehicle miles traveled, a common measure of roadway exposure. Systemic assessment involves identifying high-risk factors rather than single locations. Task 2 resulted in a statewide analysis and identification of high-risk factors and characteristics associated with alcohol-involved crashes.

Task 3: Create and Administer a Survey Based on Identified Risk Factors

Task 3 involved the construction and administration of a survey to Louisiana residents. Task 3 built upon information from Tasks 1 and 2. Researchers administered the survey online, and the results are available via the web tool.

Task 4: Interim Report

Task 4 was the interim report construction and submission. The interim report contained the methodology and findings from the first three project tasks.

Task 5: Qualitative Research Project to Investigate Identified Risk Factors of Subgroups

Task 5 was modified from its originally planned set of activities due to COVID-19. As completed, Task 5 included two components: an online survey with DUI/DWI offenders in Louisiana and structured interviews with key stakeholders. The survey allowed researchers to assess DUI/DWI offenders' beliefs and opinions regarding why people drink alcohol and drive and potential ways to prevent this high-risk behavior. The structured interviews focused on the experiences, knowledge, and opinions of key stakeholders regarding their professional engagement with DUI/DWI offenders.

Task 6: Final Report and Technical Summary

Task 6 concluded the project with the construction and submission of this final report and supporting documentation. This final report includes the methodology and findings from

the prior project tasks as well as project recommendations. Task 6 also included the delivery of the web tool for systemic assessment and a user manual.

Methodology

Methodology for Risk Factor Identification (Task 2)

Task 2 identified risk factors, including cultural and behavioral factors, associated with alcohol-involved driving and crashes using a systemic approach. Researchers analyzed data at the state and local levels to identify key contributing factors.

Data Sources

Researchers used internet searches, report and article citations, and researcher knowledge to identify data sources to assess the underlying role of culture on alcohol-involved driving and associated crashes in Louisiana. Appendix A includes a description of the data sources, which included Louisiana traffic crash data, alcohol outlet data, citation data, roadway inventory data, population-based behavioral surveillance data (e.g., Alcohol Epidemiological Data System, BRFSS, Caring Communities Youth Survey [CCYS], and CORE Survey), demographic data from the U.S. Census/American Community Survey (ACS), GIS data, school and health data, and festival data. Much of the behavioral surveillance data and geographic data was obtained by the University of Louisiana team from the Picard Center and Center for Louisiana Studies.

The motor vehicle crash data contained spatial locations of the occurred crashes. Since these locations were available, the analysis could be conducted on a small geographic scale. The topics covered by the data sources were diverse. However, for reasons such as privacy and limited resources, some data sources were only available at larger geographic levels—such as regional or state levels. Thus, it was difficult to identify patterns at the parish or lower levels. This was the main limitation of the data sources and should be considered during the interpretation of findings. Another limitation was that much of the available behavioral data was collected through state-based surveillance systems. Due to the sampling methodologies implemented for these surveys, data often were only available at the state level, which is particularly an issue for data from adults. To help address this limitation, the research team obtained many behavioral indicators for youth at the parish level. Youth behavior can be considered a surrogate of culture and adult behavior in the same parish given that alcohol use and related variables correlate among state-based surveillance systems with youth and adults [64].

Data Integration

Defining Alcohol-Involved Crashes. The research team used six years (2013–2018) of crash data from Louisiana. Researchers applied several potential scenarios to define alcohol-, drug-, and alcohol and drug–involved crashes (see Table 2). After performing several quality checks, researchers used "Definition 04" to develop the dataset for alcohol-involved crashes. Because some details were missing in the crash data (most importantly, missing BAC values in fatal crashes even though a blood test should have been conducted), researchers imputed whether alcohol was likely to have been involved in a crash using the imputation methodology developed by NHTSA. The methodology evaluates the values of the following crash characteristics: (a) crash time, (b) crash day of week, (c) officer suspicion of alcohol and/or drug involvement, (d) crash type, and (e) use of restraints. The computed probability is compared to a threshold established by NHTSA to determine whether the crash is considered alcohol related [65].

Table 2. Definitions of alcohol-involved crashes

Definition ID	Description	Filter	Data Table
Definition 01	Alcohol and Drug–Involved Crash	DR_A_D_PRES_CD1 = B (Yes, Alcohol present) OR DR_A_D_PRES_CD = C (Yes, Drugs present) OR DR_A_D_PRES_CD = D (Yes, Alcohol and Drugs present) OR DR_COND_CD = G (Drinking Alcohol—Impaired) OR DR_COND_CD = H (Drinking Alcohol—Not Impaired) OR DR_COND_CD = I (Drug Use—Impaired) OR DR_COND_CD = J (Drug Use—Not Impaired) OR [DR_ALCOHOL_CD = D (Test Given, BAC) AND BAC> 0] OR DR_DRUGS_CD = D (Drugs reported, specify in narrative)	VEHIC_TB
Definition 02	Alcohol-Involved Crash	DR_A_D_PRES_CD = B (Yes, Alcohol present) OR DR_A_D_PRES_CD = D (Yes, Alcohol and Drugs present) OR DR_COND_CD = G (Drinking Alcohol—Impaired) OR DR_COND_CD = H (Drinking Alcohol—Not Impaired) OR [DR_ALCOHOL_CD = D (Test Given, BAC) AND BAC> 0]	VEHIC_TB
Definition 03	Drug-Involved Crash	DR_A_D_PRES_CD = C (Yes, Drugs present) OR DR_A_D_PRES_CD = D (Yes, Alcohol and Drugs present) OR DR_COND_CD = I (Drug Use—Impaired) OR DR_COND_CD = J (Drug Use—Not Impaired) OR DR_DRUGS_CD = D (Drugs reported, specify in narrative)	VEHIC_TB
Definition 04	Alcohol-Involved Crash	EST_ALCOHOL[1] = 1 (alcohol involvement in the crash)	CRASH_TB

Note: Codes used in LADOTD crash database. These codes are provided for future reproducibility.
[1] Source: [65].

This study performed the data integration in two levels:

- Parish-level data integration.
- U.S. Census block-group-level data integration.

Parish-Level Data Integration. The data preparation involved two software tools: ArcGIS 10.4.1 from Esri and open-source tool R [66, 67]. The following steps were taken to develop the database. The software used in each step is shown in parentheses.

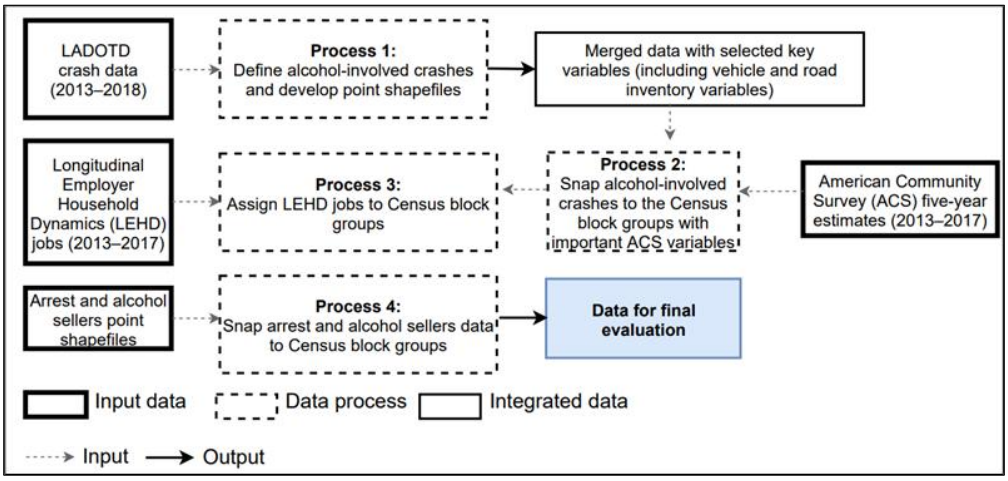
- Filter alcohol-involved crash data based on the definition selected in the earlier section. Merge vehicle and roadway inventory data to develop a comprehensive dataset (R).
- Develop ArcGIS point shapefiles from the spatial locations of alcohol-involved crashes (ArcMap).
- Assign crash locations to the parish shapefiles based on the spatial location (ArcMap).
- Extract demographic data (e.g., population, households, religion, education) and assign to the related parishes (R).
- Collect survey and cultural data (e.g., alcohol consumption, attitude toward alcohol, driving behavior, and arrest cases) to the related parishes (R).
- Collect alcohol outlet information and geocode alcohol locations to geographical information system points (i.e., latitude and longitude) (ArcMAP).

U.S. Census Block-Group-Level Data Integration. Figure 1 presents a flowchart describing the final data preparation for the systemic analysis at the meso level (a spatial area with population size that falls in between the census block and parish levels). Researchers performed the following processes to develop the final dataset:

- **Process 1:** Filter the alcohol-involved crash data based on the definition selected in the earlier section. Merge vehicle and roadway inventory data to develop comprehensive data. Develop ArcGIS point shapefiles from the spatial locations of alcohol-involved crashes (R and ArcMap).
- **Process 2:** From the ACS block group geodatabase, select tables with population and housing unit data. Assign alcohol-involved crashes to the intersected block-group-level information (R and ArcMap).

- **Process 3:** From the block-group-level Longitudinal Employer-Household Dynamics (LEHD) data, calculate block-group-level job data. Assign these data to the merged data developed at the block group level (R).
- **Process 4:** Develop ArcGIS point shapefile spatial locations of arrest data and alcohol sellers. Assign these point locations to the intersected block-group-level information. Since parish identifications are in the block-group-level database, separate data integration for the parish level was conducted through data joining in R (ArcMap, R).

Figure 1. Flowchart of data integration work for block-group-level data



Systemic Analysis

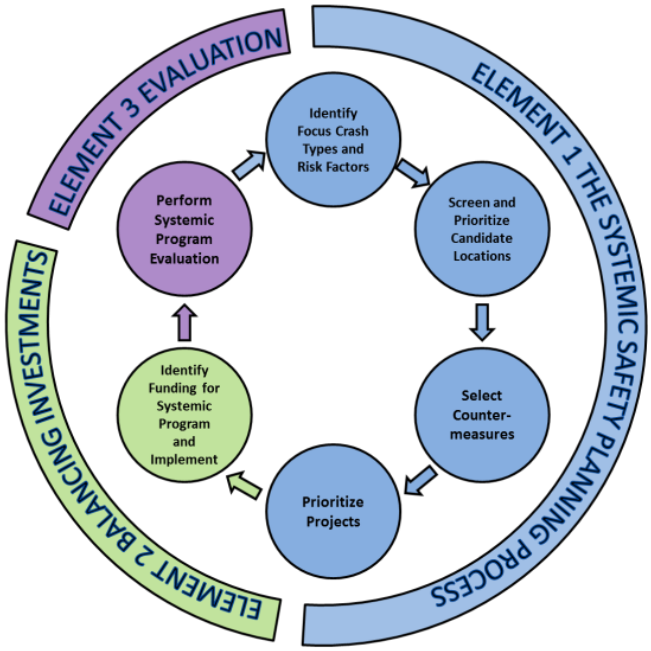
One of the most important tasks in highway safety analysis is the identification of locations that might need engineering improvements, effective programs or policies, or enhanced enforcement of laws to reduce the number of targeted crashes. The research team performed a systemic analysis to identify the key risk factors at a particular spatial area level. Researchers were able to identify which areas in Louisiana have the most alcohol-involved crashes and thus need effective countermeasures and strategies to reduce these crashes. The systemic analysis was performed at the block group level.

Concepts. Data-driven safety approaches (e.g., safety performance functions, hotspot identification) are widely used in safety management. However, these traditional approaches have certain limitations. For example, they typically rely on historical crash records and are reactive (e.g., hotspot identification can only identify locations where crashes have occurred in the past). In addition, identifying specific locations can be

difficult when overall crashes are rare, as is the case for fatal and serious injury crashes. Recently, safety analysts have proposed using the systemic approach to overcome the limitations. Instead of looking at specific high-crash locations, the systemic approach focuses on high-risk features and thus can help identify where crashes are likely to occur. The safety objective of the systemic approach is to identify high-risk factors through a system-wide analysis of specific target crash types. This approach was particularly useful for this project since the target crash type was alcohol-involved crashes and one of the primary objectives was to identify factors contributing to crashes. A systemic approach usually requires less data than traditional methods, which is another advantage. Figure 2 illustrates the framework of the systemic approach.

Transportation engineers have used the systemic approach in highway safety improvement projects. Minnesota used this approach to develop safety plans for each of its 87 counties and identified several risk factors for severe lane departure and intersection-related crashes [68, 69]. The Missouri Department of Transportation (MoDOT) applied the systemic approach to reduce fatal and serious injuries during resurfacing projects. The Texas Department of Transportation applied the systemic approach to roadway widening, horizontal curve design, and pedestrian safety improvements [70].

Figure 2. Framework of the Federal Highway Administration (FHWA) systemic tool [68]



In this project, the primary task of the systemic analysis was risk assessment. In this assessment, geographic elements (e.g., a block group) are prioritized using risk factor weights. Risk factor weights are calculated using total alcohol crashes and the crash overrepresentation (relative to the exposure) of each element. The total risk factor weight is the sum of all risk factor weights of an element for each element evaluated. Table 3, extracted from Walden et al. [70], provides the weights based on the proportion of alcohol crash overrepresentation and alcohol crash proportion when compared to exposure.

Table 3. Risk factor weight criteria

Category	Weight (points)										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Alcohol-Involved Crash	≥ 0% and < 10%	≥ 10 and < 20%	≥ 20 and < 30%	≥ 30 and < 40%	≥ 40 and < 50%	≥ 50 and < 60%	≥ 60 and < 70%	≥ 70 and < 80%	≥ 80 and < 90%	≥ 90 and < 100%	100%
Alcohol-Involved Crash Over-representation	0%	> 0% and < 2%	≥ 2% and < 3%	≥ 3% and < 4%	≥ 4% and < 5%	≥ 5% and < 6%	≥ 6% and < 7%	≥ 7% and < 8%	≥ 8% and < 9%	≥ 9% and < 10%	≥ 10% and ≤ 100%
Alcohol-Involved Crash Under-representation	0%	> 0% and < 2%	≥ 2% and < 3%	≥ 3% and < 4%	≥ 4% and < 5%	≥ 5% and < 6%	≥ 6% and < 7%	≥ 7% and < 8%	≥ 8% and < 9%	≥ 9% and < 10%	≥ 10% and ≤ 100%

Based on the weights provided in Table 3, the total weight for a risk factor can be calculated using the following equation.

$$W_t = 10 + CT + CO - CU \quad \text{where,} \tag{1}$$

W_t = total weight,
CT = weight based on proportion of alcohol crashes,
CO = weight based on alcohol crash overrepresentation compared to exposure, and
CU = weight based on alcohol crash underrepresentation.

Example. To illustrate the process of risk factor assessment, the research team selected the number of on-site sellers as an example. The following section describes the steps taken to calculate the risk factor for on-site sellers at the block group level.

First, the research team grouped the 3,471 block groups into three levels based on the number of on-site alcohol sellers: (1) low = no on-site alcohol seller; (2) medium = one

or two on-site alcohol sellers; and (3) high = three or more on-site alcohol sellers. Among the 3,471 block groups, 1,538 were low (i.e., having no on-site alcohol sellers), 1,145 were medium (i.e., having one or two on-site alcohol sellers), and 788 were high (i.e., at least three on-site alcohol sellers).

Second, the research team calculated the total number of exposures for each level of the block groups. The research team selected several variables as the exposure (e.g., total crash number, population, state-maintained roadway length). With population as the exposure, the estimated points for the factors considered in the systemic analyses had a wider range, and they were more sensitive to the target crashes (i.e., alcohol-involved crashes) than when selecting the other two (i.e., total crash number, state-maintained roadway length). The number of alcohol-involved crashes in one area was generally proportional to the population. The total population in Louisiana is 4,663,461, and the population in the 1,538 low block groups (i.e., no on-site alcohol sellers) was 1,860,636, accounting for 39.9 percent. Similarly, the proportion in the other two levels of block groups were 33.8 percent and 26.3 percent, respectively, as Figure 3 shows.

Third, the research team calculated the number of KA (i.e., fatal and suspected serious injury) alcohol-related crashes in each level of block group. In the 1,538 low block groups (i.e., no on-site alcohol sellers), the number of KA alcohol-involved crashes was 1,009 in six years (2013–2018), accounting for 32.7 percent of the total KA alcohol-involved crashes in the state (i.e., 3,082). Compared to the proportion of population in the block groups, the KA alcohol-involved crashes were underrepresented (i.e., 32.7 percent versus 39.9 percent). The proportion of KA alcohol-involved crashes in the other two levels of block groups were 33.8 percent and 33.5 percent, respectively. The results are plotted Figure 3. The KA alcohol-involved crashes were highly overrepresented when the number of on-site alcohol sellers was high. One of the main objectives of this project is to reduce fatal alcohol-involved crashes. However, fatal crashes are rare, and a low sample size makes the results less reliable or stable. To make the systemic analyses more accurate, the research team selected KA alcohol-involved crashes as the target crash type to address the most severe crashes while still producing stable results.

Figure 3. Proportion of KA alcohol-involved crashes as a function of on-site alcohol seller

Finally, the research team evaluated the weight points for on-site alcohol sellers. When the level of on-site alcohol sellers was low in one block group (e.g., no on-site alcohol seller), the proportion of KA alcohol-involved crashes was 32.7 percent, so CT = 3; The KA alcohol-involved crashes were not overrepresented, so CO = 0; instead, they were underrepresented, and the difference was 7.2 percent (i.e., 39.9 percent − 32.7 percent), so CU = 7. The total weight for low on-site alcohol sellers was:

$$W_t = 10 + CT + CO - CU = 10 + 3 + 0 - 7 = 6 \quad (2)$$

Similarly, the weights for medium and high on-site alcohol sellers were calculated as 13 and 20, respectively. The factor of on-site alcohol sellers was positively associated with KA alcohol-involved crashes. As the number of on-site alcohol sellers increased, the risk of having KA alcohol-involved crashes also increased, which follows the findings of previous studies [51].

Table 4 shows the thresholds and weights for on-site alcohol sellers.

Table 4. Thresholds and weights for on-site alcohol sellers

Variable	Level	Range	Weight Points
On-Site Alcohol Seller	Low	0	6
	Moderate	[1–2]	13
	High	[3–91]	20

Block-Group-Level Systemic Analysis. The research team conducted a correlation analysis at the block group level between alcohol-involved crashes and variables and

determined that the following nine factors were the most informative. Thus, these factors were used in the systemic analysis.

- On-site alcohol sellers (in the year 2018).
- Off-site alcohol sellers (in the year 2018).
- Number of arrested cases (2016–2018).
- Number of intersections.
- Average number of jobs by block group.
- Males age 25–34 years—total population estimate.
- Households—total population estimate.
- Residence area characteristic (RAC).
- Work area characteristic (WAC).

The research team selected the risk factors based on correlation analysis at the block group level as well as data availability. Although nine factors were selected, other factors might affect alcohol-involved crashes. For example, lighting is an important factor for alcohol-involved pedestrian crashes; however, lighting information was not available.

The Discussion of Results section presents the analysis results for each factor (except on-site alcohol sellers, which was presented in the previous section as an example).

Methodology for General Population Survey (Task 3)

The objective of Task 3 was to create and administer a survey based on information from the literature review (Task 1) and data analysis (Task 2). The overarching goal of the survey was to assess knowledge, attitudes, behaviors, and cultural aspects relating to drinking and driving in Louisiana and how to reduce the behavior and improve roadway safety. The research team developed a self-administered survey and delivered it to participants online. The research team analyzed the survey data using descriptive statistics. Selected findings are presented below. The data for each variable are available in aggregate via the online tool.

General Population Survey Construction

The research team started the survey development process by reviewing a variety of prior surveys on alcohol consumption, driving, and traffic safety within the context of the findings from Task 1 (literature review) and Task 2 (data analysis). The prior surveys included the American Automobile Association (AAA) Safety Culture Survey, American College Health Association National College Health Assessment, BRFSS, CCYS, NHTSA National Survey of Drinking and Driving Attitudes and Behaviors, NHTSA National Roadside Survey, National Opinion Research Center at the University of Chicago 2018 survey, Traffic Injury Research Foundation USA Road Safety Monitor, and Uber and Mothers Against Drunk Driving survey on trip planning and ride sharing. The survey results are presented in both plot and table formats in the interactive tool (https://ladotd.shinyapps.io/LA_Alcohol_Tool/).

The research team identified broad content domains for the survey as (a) demographics and religion, (b) indicators of safety culture, (c) alcohol consumption, (d) drinking and driving, (e) trip planning, and (f) countermeasures. The research team adapted items from the prior surveys and created new items when needed. Then, the research team reviewed the items and revised the survey instrument in an iterative process that included the completion of a cognitive interview. A cognitive interviewing approach is used by survey designers to ensure that the survey items are capturing the information that the researcher intends to capture. The next version of the survey was submitted to the Louisiana Transportation Research Center (LTRC) Panel for review and comment. Final edits were made following the LTRC Panel review.

After all revisions were complete, the research team entered the final survey items into Qualtrics, an online survey application. Qualtrics has an advantage over other survey applications in that skip patterns can be programmed into the system so items that are not relevant for certain respondents are not presented to them, which decreases survey burden and fatigue. The base set of questions included 61 items. A copy of the survey can be found in Appendix B. The Qualtrics survey and accompanying informed consent information sheet were submitted for review and approval to the Texas A&M University Institutional Review Board.

General Population Survey Administration

To efficiently reach a qualified sample of adult survey respondents from across Louisiana, the research team used the Amazon Mechanical Turk (MTurk) crowdsourcing

marketplace. MTurk enables researchers to specify that respondents have certain characteristics—such as living in Louisiana. MTurk also allows researchers to compensate participants for their time without having to know their identity. Therefore, the survey could be anonymous. Participants were compensated $5 for their time. The target population consisted of licensed drivers aged 21 years and older who were also residents of Louisiana. Once a potential respondent read the informed consent information sheet and agreed to participate, he or she began the survey. The survey was available on MTurk from April 7, 2020, to July 3, 2020. The median time to complete the survey was 12 minutes, while the mean time was 33 minutes.

A total of 445 individuals responded to the survey. The analyzed sample size was 411 respondents. Reasons for removing respondents from the analyzed dataset were the following: 21 incompletes, 12 never drivers, and 1 individual who had a pattern of invalid or inconsistent responses.

Methodology for DUI/DWI Offender Survey and Structured Interviews with Stakeholders (Task 5)

The objective of Task 5 was to gain a greater understanding of DUI or DWI in Louisiana by creating and administering (a) a survey to assess the attitudes and opinions of Louisiana residents who had received a citation for DWI or DUI, also referred to as offenders; and (b) structured interviews with Louisiana stakeholders engaged with adults with a history of DUI or DWI. The overarching goal of Task 5 was to gather qualitative information from DUI and DWI offenders on how to prevent drinking and driving as well as the perspective of individuals who engage with DUI and DWI offenders as a function of their profession. The research team developed a self-administered survey that was delivered to participants online as well as structured interviews that were administered by phone. The research team analyzed the survey data using descriptive statistics and examined the interview data to identify key themes. Selected findings from the survey and key themes from the structured interviews are presented below.

DUI/DWI Offender Survey

Given a lack of standardized surveys focusing on the attitudes, beliefs, and opinions of people with one or more DWIs or DUIs, the research team based the DUI/DWI offender survey on information from the LTRC Panel and the results of the prior project tasks. Due

to COVID-19 constraints, researchers administered the survey online via Qualtrics. Since DUI or DWI offenders are a vulnerable population according to the Texas A&M Institutional Review Board, the survey collected minimal information that could be used to identify a participant. For example, the survey included no names or addresses. Only an email address was requested to disseminate the compensation for participation ($35 Amazon electronic gift cards). The survey included 19 unique items in addition to the initial screening question. Of these, the content areas included demographics, history of DUI or DWI charges, details on the most recent DUI/DWI charge, and opinions on how to prevent DUIs or DWIs in Louisiana. The survey instrument is provided in Appendix C. To recruit participants, a social media posting was put on Facebook, as shown in Figure 4. The target population consisted of individuals aged 21 years and older who were also residents of Louisiana and had a history of a DUI or DWI. Amazon MTurk crowdsourcing marketplace was not used for this population, as it was in Task 3, due to concern that there would not be enough individuals with a prior DUI/DWI participating in MTurk.

Figure 4. Texas A&M Transportation Institute–developed social media advertisement

Once potential respondents read the social media advertisement and clicked the link, they went to a screening question to confirm their eligibility to participate in the survey. If they confirmed their eligibility, they then read the informed consent information sheet. Once they agreed to participate, respondents started the survey. The survey link was live in Qualtrics from January 15 to 17, 2021. The median time to complete the survey was 11 minutes, while the mean time was 15 minutes. A total of 61 participants completed the survey with viable responses.

Structured Interviews with DUI/DWI Stakeholders

Structured interviews were completed from November 1 to December 18, 2020. Contacts were initiated either through Dr. T. Scott Smith directly or through secondary referrals. Dr. Smith introduced himself as a research contractor for the Texas A&M University Transportation Institute. All interviews were completed via phone, and none were recorded through audio or video formats. Written notes were taken during the interviews. Interview length ranged from approximately 10 to 20 minutes. While informed consent forms were not signed by the participants because this activity was not deemed as human subjects research, participants were advised that their responses and identification would be kept confidential. Participants were advised that general geographic areas, age, and years in professional service would be recorded, but individual names and specific parish of origin would not be collected. Table 5 summarizes the demographics of interview participants. The interview items are listed in Appendix D.

Table 5. Description of structured interview participants

Profession	Number of Interviews	Age Range in Years	Range of Years in Professional Service	Geographic Areas
Police Officers	3	35–55	12–25	Monroe and Shreveport areas
Probation Officers	4	29–55	10–25	Lafayette, Monroe, and New Orleans areas
Pastors	3	25–32	2–7	Alexandria, New Orleans, and Shreveport areas
Counselors/Therapists	2	50–52	25–27	Alexandria and Shreveport areas
Defense Attorneys	4	45–60	10–32	Alexandria, Lafayette, New Orleans, and Shreveport areas
Assistant District Attorneys	3	37–45	10–18	Alexandria, Houma/Thibodeaux, and Monroe areas

Discussion of Results

Results for Risk Factor Identification (Task 2)

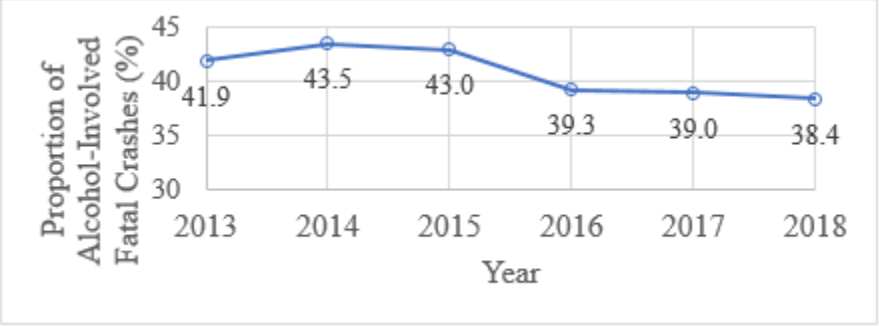
Descriptive Analysis Results

Overrepresentation Identification. The alcohol-involved crash factor is a critical concern among all crashes due to its overrepresentation in fatal crashes compared to minor injury and property damage only (PDO) crashes. Table 6 lists alcohol-involved crashes from 2013 to 2018 by severity type. Figure 5 illustrates that alcohol-involved crashes contributed 38 percent to 44 percent of all fatal crashes from 2013 to 2018. The highest percentage was found in 2014 (44 percent of all fatal crashes), and a decline in percentage was observed after 2014, with 38 percent reported in 2018.

Table 6. Alcohol-involved crashes by severity type

Year	Fatal (K)	Incapacitating Injury (A)	Non-incapacitating Injury (B)	Possible Injury (C)	Property Damage Only (PDO or O)	Total Crashes (KABCO)
2013	273	250	1,060	2,066	4,592	8,241
2014	288	242	1,068	2,093	4,686	8,377
2015	300	281	1,039	2,151	4,648	8,419
2016	277	240	998	1,999	4,496	8,010
2017	272	202	907	1,788	4,157	7,326
2018	273	216	877	1,799	4,248	7,413
2013–2018	1,683	1,431	5,949	11,896	26,827	47,786

Figure 5. Proportion of alcohol-involved fatal crashes to total fatal crashes (2013–2018)



The profile of alcohol-involved crashes differs from the profile of non-alcohol crashes. Figures 6–8 illustrate these differences graphically. Figure 6 illustrates the proportions of alcohol-involved crashes and all crashes by severity type. Fatal crashes were disproportionately high in alcohol-involved crashes. Around 40.7 percent of all fatal crashes were alcohol-involved crashes. The analysis was based on police-reported crashes. Some alcohol-involved crashes might have been undetected.

Figure 6. Proportion of alcohol-involved crashes by severity type

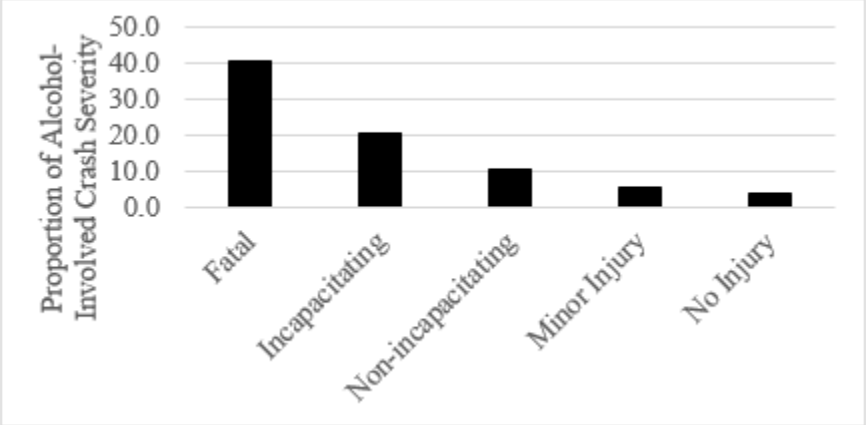


Figure 7 displays the distribution of all crashes (including alcohol-involved crashes) and alcohol-involved crashes by day of the week. An overrepresentation is identified when the percentage for the alcohol-involved crashes, or bar height, exceeds the percentage for crashes overall. Figure 7 shows that alcohol-involved crashes were more likely on Saturday and Sunday and less likely on weekdays. Alcohol use increases on the weekend when many people need not be at work and are prone to drink more [71].

Figure 7. Distribution of crashes by day of the week

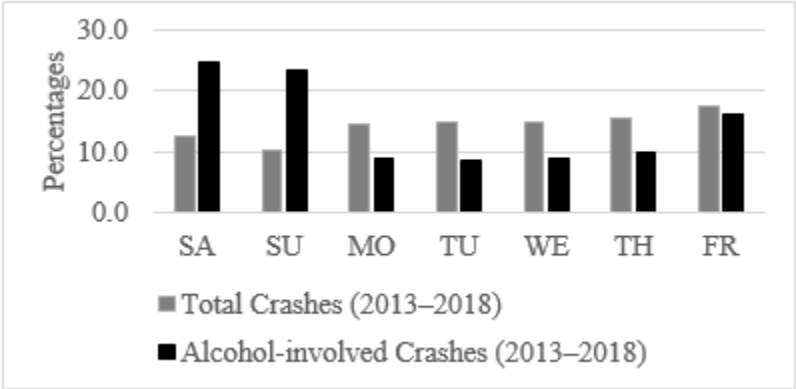
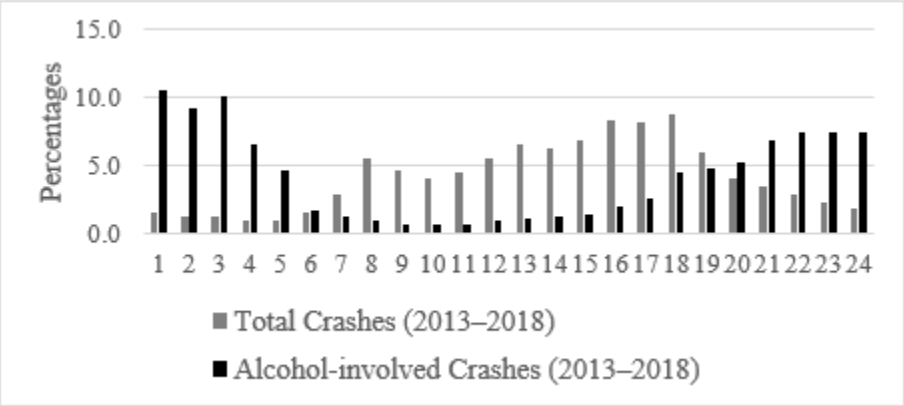


Figure 8 illustrates the distribution of crashes by hour of the day (the x-axis represents the hour of the day). Alcohol-involved crashes were overrepresented from 8:00 p.m. until 6:00 a.m. The degree of overrepresentation increased steadily from 8:00 p.m. until 6:00 a.m. Like days of the week, this pattern also reflects alcohol consumption behavior—that is, alcohol consumption increases during the nighttime and early-morning hours.

Figure 8. Distribution of crashes by hour of the day



Regarding collision type, alcohol-involved crashes involving a non-collision with a motor vehicle (i.e., single-vehicle crash) showed by far the greatest discrepancy, at 51.8 percent compared to only 14.9 percent for all crashes. The most common collision type for all crashes was rear end (35.5 percent), which accounted for only 18.0 percent of alcohol-involved crashes. These and subsequent statistics are presented in Appendix E.

For the distribution of locality type for alcohol-involved versus all crashes, alcohol-involved crashes were more likely to occur in residential areas and areas identified as open country. All other type crashes were most common in business or industrial areas (business and mixed residential, business continuous, and industrial).

Regarding highway type by alcohol-involved versus all crashes, the distribution for alcohol-involved crashes was similar to all crashes. The exceptions included larger proportions on state highways and parish roads.

For roadway type for alcohol-involved versus all crashes, a two-way roadway with no physical separation was the most common for alcohol-involved crashes, at 65.2 percent. This percentage was higher than for total crashes, at 55.9 percent. Two-way roadways with no physical barrier or separation are harder for impaired drivers to negotiate; they

find it harder to stay in their own lane and on the right side of the road. Once a driver crosses into the opposite direction of travel, the likelihood of interaction with another vehicle and a crash increases. However, these percentages represent raw counts and do not account for travel frequency or number of drivers across each of these roadway types.

Regarding alcohol-involved crashes versus all crashes by gender, males were overrepresented in alcohol-involved crashes—57 percent versus 50 percent for all crashes. Similarly, unknown gender was overrepresented for alcohol-involved crashes—19 percent versus 8 percent for all crashes. Males are often overrepresented in high-risk crash types. The reason for unknown gender being overrepresented is not clear.

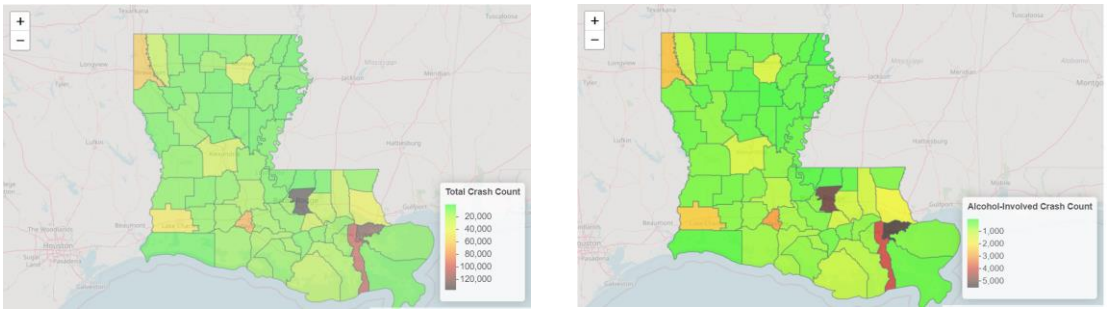
For the distribution of age for alcohol-involved versus all crashes, alcohol-involved crashes were more common among drivers ages 25 to 34 years. The distribution was similar otherwise, except that unknown age accounted for 20 percent of alcohol-involved crashes but only 8 percent of all crashes.

For the distribution of some of the key contributing factors, single-vehicle crashes were overrepresented in alcohol-involved crashes (52 percent versus 17 percent for all crashes). Distracted driving crashes were slightly more represented in alcohol-involved crashes than all crashes (34 percent versus 30 percent). For speed-related crashes, alcohol-involved crashes were slightly overrepresented (1 percent versus 0.4 percent).

Exploratory Analysis at the Parish Level. Culturally relevant population-based data beyond demographics are difficult to obtain at geographies lower than the parish level for privacy reasons or because they are simply not collected. For population-based surveys such as the BRFSS, collecting enough surveys to represent geographies lower than the state level can cost a Louisiana parish tens of thousands of dollars a year. Therefore, a descriptive analysis of culturally relevant data was undertaken at the parish level. Frequencies, percentages, and correlations were produced, along with selected visualizations of the data using heat maps.

Figure 9 shows the heat maps for the total and alcohol-involved crashes for 2013–2018 in Louisiana parishes. Parishes having a higher number of total crashes also experienced a higher number of alcohol-involved crashes.

Figure 9. Frequency of total and alcohol-involved crashes by parish

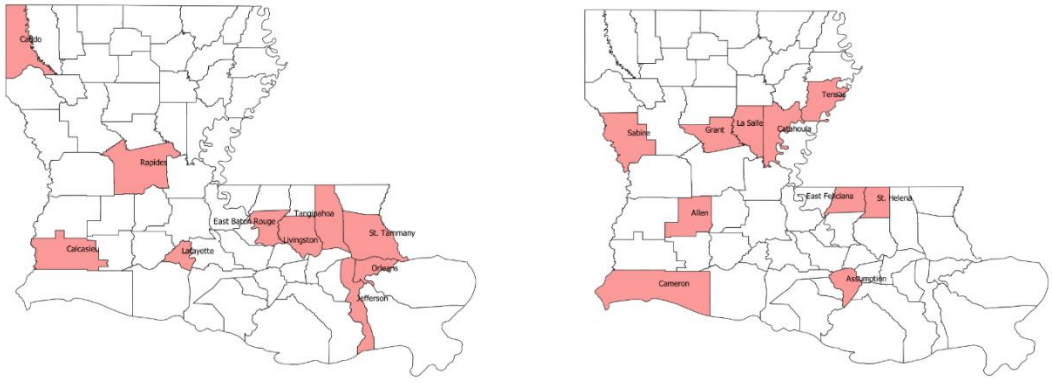


Total crashes Alcohol-involved crashes

Similar to the geographical variation observed for alcohol-involved crashes, geographical variation also existed in potentially related cultural factors. For example, the primarily Protestant parishes had a lower prevalence of alcohol consumption. Parishes with higher median incomes had higher alcohol consumption.

The frequency of alcohol-involved crashes were cross-referenced with the frequency of alcohol outlets. The top 10 parishes with the highest number of alcohol-involved crashes were Caddo, Calcasieu, East Baton Rouge, Jefferson, Lafayette, Livingston, Orleans, Rapides, St. Tammany, and Tangipahoa. The top 10 parishes with the highest alcohol-involved crash percentage were Allen, Assumption, Cameron, Catahoula, East Feliciana, Grant, La Salle, Sabine, St. Helena, and Tensas. A parish with higher alcohol-involved crash counts did not necessarily also have a higher alcohol-involved crash percentage (i.e., percentage of alcohol-involved crashes among all crashes). The former was associated with the overall exposure, such as population and VMT. High counts concentrated in high population centers within the state. The low percentages concentrated within rural locales of the state. Cameron Parish and parishes located in the eastern-central or delta region parts of the state are particularly problematic. Figure 10 and Appendix E provide additional information.

Figure 10. Top parishes with alcohol-involved crash count and percentage



Count Percentage

Regarding the geographic distribution of on-site and off-site alcohol sellers, usually a parish had more on-site alcohol sellers if there were more off-site alcohol sellers. A few parishes, such as West Baton Rouge, West Carroll, West Feliciana, and Winn, had only off-site alcohol sellers. These variations reflected religious affiliation. Namely, the Protestant-heavy section of the state, primarily north of Rapides Parish, had fewer on-site and off-site sellers. However, there were some exceptions, particularly Caddo and Bossier Parishes, which are heavily populated, and Lincoln and Ouachita Parishes. These variances are likely due to high population density in Ouachita Parish and presence of Louisiana Tech students in Lincoln Parish, along with accompanying alcohol distribution sites to accommodate these college students.

To understand the extent to which cultural factors at the parish level were associated with the number of fatal alcohol-involved crashes and the proportion of all fatal crashes that involved alcohol, correlations were computed. Correlations range from −1.00 to 1.00. The closer a value is to −1.00 or 1.00, the stronger the correlation. A positive correlation means that as the frequency of one variable increases, so does the frequency of the second variable. A negative correlation means that as the frequency of one variable increases, the frequency of the second variable decreases, which is also known as an inverse relationship. The p-value is a measure of statistical significance. A p-value < 0.05 indicates that the correlation is not a chance finding. Variables can be prioritized based on how close their value is to 1.00 or −1.00 and whether their p-value is < 0.05.

Table 7 displays selected correlations for the two measures of alcohol crash occurrence: the count of fatal alcohol-involved crashes and the proportion of all fatal crashes that

involved alcohol. Fatal crashes were selected for this analysis since the alcohol-involved element is assessed more completely for fatal crashes. As the severity of a crash decreases, the assessment of alcohol impairment often decreases. Consequently, fatal crashes have the least bias regarding classifying a crash as alcohol involved or not. Fatal alcohol crash counts were highly correlated with population size ($r = 0.87$) and annual VMT ($r = 0.89$), as shown in Table 7. This finding may simply be because as population and miles driven increase, so do crashes overall. This feature may explain why no strong correlation exists with the proportion of fatal alcohol-involved crashes—which would be less likely to be influenced by population size and VMT. Other factors significantly correlated with the number of fatal alcohol-involved crashes, but not the proportion, included median household income ($r = 0.26$), percent of population female ($r = 0.36$), number of alcohol arrests ($r = 0.81$), and number of bars per capita ($r = 0.71$). These factors also were correlated with population size and might be, after considering the population size, strongly related to the frequency of fatal alcohol-involved crashes. Age was correlated with fatal alcohol-involved crash counts and the proportion.

Regarding alcohol drinking and perceptions, excess alcohol consumption reported by adults ($r = 0.36$) and youths' perception that adults drinking alcohol in public is not wrong ($r = 0.42$) were moderately correlated with the alcohol-involved crash count but not with the alcohol-involved crash proportion.

Youths' reported use of marijuana in the past 30 days was moderately correlated with the alcohol-involved crash count ($r = 0.42$) and, to a lesser extent, the alcohol-involved crash proportion ($r = 0.14$). A moderate inverse correlation existed between the youth protective score (indicator of factors that protect against risky behaviors) and the proportion of alcohol-involved crashes ($r = -0.35$) but not the overall alcohol-involved crash count.

Overall, the correlations support the premise that younger populations (e.g., under 25 years old) have more alcohol-involved crashes. As the age groups increased, the proportion and number of alcohol-involved crashes decreased, especially in populations age 65+ years ($r = -0.26$), but this pattern may also be true for crashes in general. However, unlike crashes in general, a population with a large percentage of youth under 18 was positively correlated with the proportion of alcohol-involved crashes ($r = 0.27$).

Overall, the correlations at the parish level indicate that being Protestant, older, and afforded more protective factors against at-risk behavior in youth are linked with decreased alcohol-involved crashes. Greater prevalence of high-risk behaviors such as excessive alcohol use in adults and marijuana use in youth may be indicators of parishes

having an increased risk of alcohol-involved crashes. Correlations observed at the parish level may not reflect associations at the individual driver level. Appendix E contains the correlations for all the examined variables.

Table 7. Selected correlations between fatal alcohol-involved crash counts and proportion of total fatal crashes and cultural factors at the parish level

Variable	Fatal Alcohol-Involved Crash Count	p-value	Fatal Alcohol-Involved Crash Proportion	p-value
Alcohol Crash Count	1.00	N/A	0.28	0.027
Number of Housing Units	0.87	<0.001	0.11	0.408
Population Estimate (2016)	0.87	<0.001	0.11	0.405
Annual Vehicle Miles Traveled (2017)	0.89	<0.001	0.10	0.449
Median Annual Household Income	0.26	0.039	0.05	0.700
Percentage of Population—Female	0.36	0.004	−0.03	0.823
Percent of Population—Under 18 Years	0.08	0.542	0.27	0.033
Percent of Population—18 to 24 Years	0.30	0.018	0.06	0.610
Percent of Population—25 to 44 Years	0.24	0.058	0.14	0.279
Percent of Population—45 to 64 Years	−0.27	0.034	−0.21	0.102
Percent of Population—65+ Years	−0.40	<0.001	−0.26	0.035
Percent of Population—Mainline Protestant Religion (2010)	0.10	0.437	−0.30	0.015
Number of Arrests with BAC ≥0.08 (2018)	0.81	<0.001	0.09	0.475
Number of Bars per Capita	0.71	<0.001	0.09	0.474
Percent of Population—Adults Reporting Excess Alcohol Use	0.36	0.003	0.18	0.165
Percentage of Youth—Not Wrong for Adults to Drink Alcohol in Public (2016)	0.42	<0.001	0.14	0.256
Percentage of Youth—Reported Marijuana Use—Past 30 Days (2016)	0.42	<0.001	0.26	0.039
Percentage of Youth—High Total Protection Score for Being at Risk (2010)	−0.02	0.864	−0.35	0.005

Note: N/A = not applicable.

Exploratory Analysis at the Census Block Group Level. The Standard Hierarchy of Census Geographic Entities [72] displays the associations between different spatial boundaries maintained by the U.S. Census Bureau, as Figure 11 illustrates. In the hierarchy, *block* is considered the smallest spatial unit. The research team considered block groups as the meso unit level to perform this analysis. A block-group-level analysis

can provide granularity and many unique conditions to analyze and may make it easier to implement countermeasures or other types of interventions or conduct enforcement efforts at the local level. Table 8 shows that Louisiana has 3,471 block groups. Block groups labeled as water were not included in the analysis [73].

Figure 11. Hierarchy of census spatial units

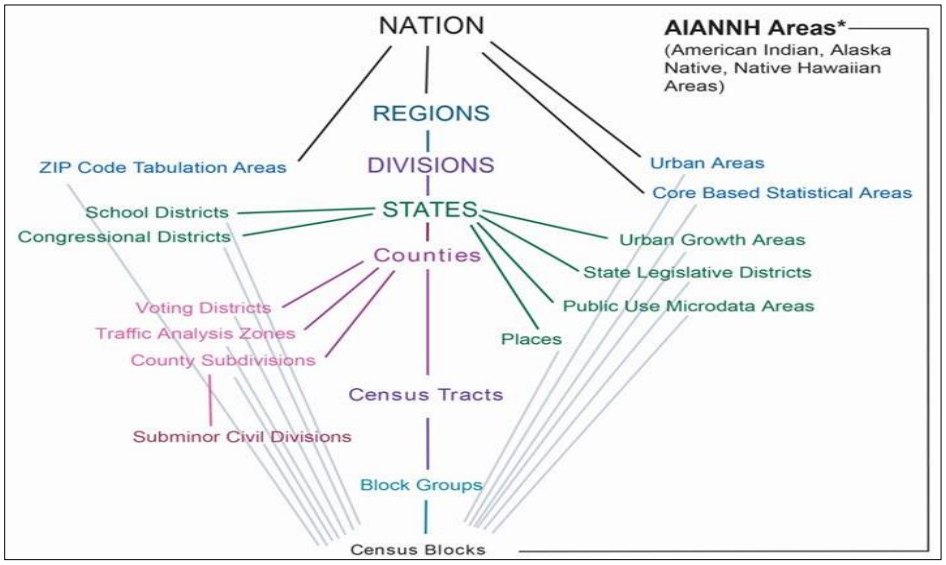


Table 8. Tallies of census tracts, block groups, and blocks in 2010 [73]

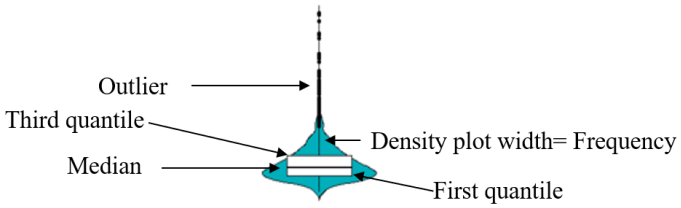
State FIPS	Name	Census Tracts	Census Tracts (water only)	Block Groups	Block Groups (water only)	Blocks	Blocks (water only)
22	Louisiana	1,148	12	3,471	12	204,447	14,740
	U.S.	73,057	317	217,740	557	11,078,297	541,776

The systemic analysis began by identifying factors having a major impact on alcohol-involved crashes, also known as key contributing factors at the block group level. Based on Task 1, the research team preliminarily selected 19 independent variables. Six correlation plots were generated to determine the key contributing factors. Appendix F includes the correlation analysis and the descriptive statistics for these key variables.

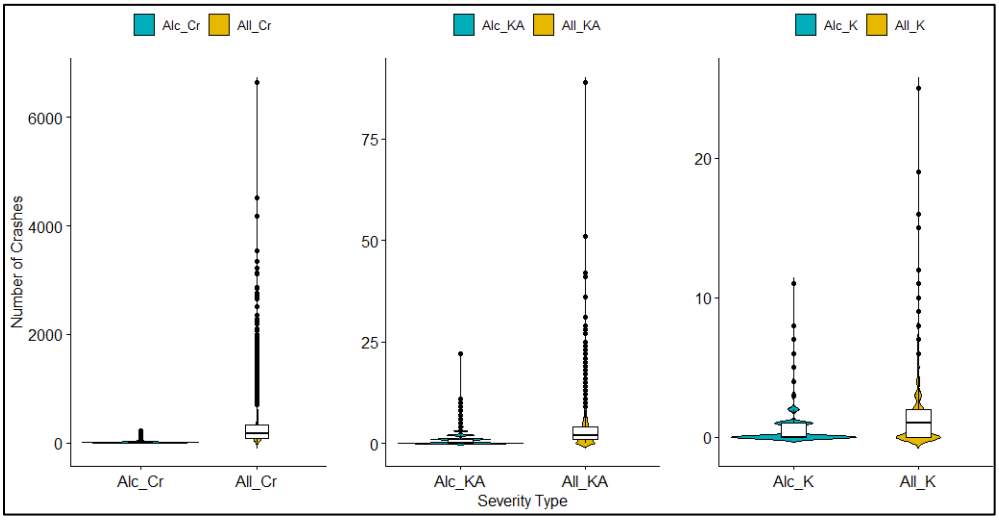
Adequate graphics are needed to understand the distribution of the variable measures. Violin plots are similar to box and whisker plots because they compare distributions of quantitative data across several levels of categories. They show the variabilities between key contributing factors (see Figure 12a). Unlike the box plot, the violin plot illustrates a

kernel density estimation of the underlying distribution to reveal peaks, valleys, and bumps in distribution patterns, which can be an effective way to show multiple distributions of data at once; however, the estimation procedure is influenced by the sample size, so violins for relatively small samples might look misleadingly smooth. The thickness of the distributions between bumps for each plot can show the distribution of the frequencies for values in the y-axis. Figure 12b displays the violin plot for alcohol involvement and crash severity. Additional plots are available in Appendix G for RAC, household units, and young male and female populations, which exhibited a similar trend in count distribution.

Figure 12. Box and violin plots of crash severity types



(a) Interpretation of a violin plot



(b) Distribution of crash severity types

Systemic Analysis Results

Based on the correlation analysis, the following risk factors were selected for further discovery at the block group level: on-site alcohol sellers (in the year 2018), off-site alcohol sellers (in the year 2018), number of arrested cases (2016–2018), number of intersections, average number of jobs by block group, males age 25–34 years—total population estimate, households—total population estimate, RAC, and WAC. Appendix H provides specific plots of the data for each category.

Off-Site Alcohol Sellers. For the proportion of KA alcohol-involved crashes as a function of off-site alcohol sellers, in block groups with low, medium, and high levels of off-site alcohol sellers, the corresponding population proportions were 39.4 percent, 36.3 percent, and 24.3 percent, respectively. The proportions of KA alcohol-involved crashes in the three levels of block groups were 29.0 percent, 37.1 percent, and 33.9 percent, respectively. Table 9 lists the thresholds and weights for off-site alcohol sellers.

Table 9. Thresholds and weights for off-site alcohol sellers

Variable	Level	Range	Weight Points
Off-Site Alcohol Seller	Low	0	2
	Moderate	[1–2]	14
	High	[3–34]	22

Number of Arrested Cases. For the proportion of KA alcohol-involved crashes as a function of alcohol-involved arrests, in block groups with low, medium, and high levels of arrested cases, the corresponding population proportions were 27.9 percent, 43.4 percent, and 28.7 percent, respectively. The proportions of KA alcohol-involved crashes in the three levels of block groups were 17.6 percent, 43.2 percent, and 39.2 percent, respectively. Table 10 shows the thresholds and weights.

Table 10. Thresholds and weights for number of arrests

Variable	Level	Range	Weight Points
Number of Arrests	Low	[0–1]	1
	Moderate	[2–8]	13
	High	[9–245]	23

Number of Intersections. For the proportion of KA alcohol-involved crashes as a function of number of intersections, in block groups with low, medium, and high levels of intersections, the corresponding population proportions were 24.0 percent, 48.0 percent, and 28.0 percent, respectively. The proportions of KA alcohol-involved crashes in the three levels of block groups were 10.7 percent, 46.4 percent, and 43.0 percent, respectively. Table 11 provides the thresholds and weights.

Table 11. Thresholds and weights for number of intersections

Variable	Level	Range	Weight Points
Number of Intersections	Low	[0–1]	1
	Moderate	[2–21]	13
	High	[22–110]	24

Average Number of Jobs. For the proportion of KA alcohol-involved crashes as a function of average number of jobs by block group, in block groups with low, medium, and high average number of jobs, the corresponding population proportions were 13.3 percent, 49.5 percent, and 37.1 percent, respectively. The proportions of KA alcohol-involved crashes in the three levels of block groups were 13.3 percent, 46.2 percent, and 40.5 percent, respectively. Table 12 lists the thresholds and weights.

Table 12. Thresholds and weights for average number of jobs

Variable	Level	Range	Weight Points
Average Number of Jobs	Low	[0–222]	11
	Moderate	[223–606]	11
	High	[607–14,047]	17

Males Ages 25–34 Years—Total Population Estimate. For the proportion of KA alcohol-involved crashes as a function of population of young males (ages 25–34 years), in block groups with low, medium, and high levels of a young male population, the corresponding population proportions were 31.1 percent, 35.4 percent, and 33.4 percent, respectively. The proportions of KA alcohol-involved crashes in the three levels of block groups were 37.7 percent, 33.8 percent, and 28.5 percent, respectively. The thresholds and weights for population of males (24–35 years) are shown in Table 13.

Table 13. Thresholds and weights for population of males (25–34 years)

Variable	Level	Range	Weight Points
Population of Males (25–34 years)	Low	[0–65]	19
	Moderate	[66–143]	12
	High	[144–1,585]	8

Number of Households. For the proportion of KA alcohol-involved crashes as a function of households, in block groups with low, medium, and high levels of household numbers, the corresponding population proportions were 11.3 percent, 44.3 percent, and 44.4 percent, respectively. The proportions of KA alcohol-involved crashes in the three levels of block groups were 16.6 percent, 46.3 percent, and 37.1 percent, respectively. Table 14 shows the thresholds and weights for number of households.

Table 14. Thresholds and weights for number of households

Variable	Level	Range	Weight Points
Number of Households	Low	[0–306]	16
	Moderate	[307–633]	15*
	High	[634–2829]	6

*The weight point is 15 rather than 16; the difference is caused by rounding in the calculation process (i.e., the overrepresentation is 46.30 − 44.33 = 1.97, not 2.0).

Residence Area Characteristic. For the proportion of KA alcohol-involved crashes as a function of the RAC, in block groups with a low, medium, and high level of the RAC, the corresponding population proportions were 12.2 percent, 44.6 percent, and 43.2 percent, respectively. The proportions of KA alcohol-involved crashes in the three levels of block groups were 16.2 percent, 47.9 percent, and 35.9 percent, respectively. Table 15 provides the thresholds and weights for the RAC.

Table 15. Thresholds and weights for residence area characteristic

Variable	Level	Range	Weight Points
Residence Area Characteristic	Low	[0–318]	15
	Moderate	[319–676]	17
	High	[677–3,561]	6

Work Area Characteristic. For the proportion of KA alcohol-involved crashes as a function of the WAC, in block groups with a low, medium, and high level of the WAC, the corresponding population proportions were 18.1 percent, 51.8 percent, and 30.2 percent, respectively. The proportions of KA alcohol-involved crashes in the three

levels of block groups were 14.5 percent, 47.6 percent, and 37.9 percent, respectively. The thresholds and weights are shown in Table 16.

Table 16. Thresholds and weights for work area characteristic

Variable	Level	Range	Weight Points
Work Area Characteristic	Low	[0–59]	8
	Moderate	[60–506]	10
	High	[507–27,382]	20

Risk Factor Weight Points. The research team applied the risk assessment method and evaluated the points for each factor (as shown in Table 17). One factor (i.e., RAC) showed a U-shape (or inverted U-shape) distribution with alcohol-involved crash risk, which might be counterintuitive. One possible explanation is that this variable is highly correlated with population (data shown in Appendix F). The variable was kept in the analysis since the literature review and preliminary analyses indicated that it affects alcohol-involved crashes.

For each block group, the research team calculated the weight points for every risk factor. The sum of the weight points for the risk factors was considered to be the total weight points for the block group. As the total weight points increased, the risk of KA alcohol-related crashes increased. Based on the total weight points of all the block groups, the research team divided the risk into three levels: low (total weight points below 94), medium (total weight points between 94 and 125), and high (total weight points greater than 125). Appendix I displays the top 50 block groups with the highest total weight points. Compared to historical crash data analysis, systemic analysis provides predictive measures of risk assessment. For example, block group “220710017511” experienced the highest number of alcohol-involved crashes during the study period (i.e., 2013–2018). However, this block group was ranked in the ninth tier based on the generated total points. This ranking indicates that compared to crash-only hotspot analysis, systemic analysis provides more insight based on the associated variable measures and total points.

Table 17. Risk factor weight points (KA)

Variable	Level	Range	Weight Points
On-Site Alcohol Seller	Low	0	6
	Moderate	[1–2]	13
	High	[3–91]	20
Off-Site Alcohol Seller	Low	0	2
	Moderate	[1–2]	14
	High	[3–34]	22
Number of Arrests	Low	[0–1]	1
	Moderate	[2–8]	13
	High	[9–245]	23
Number of Intersections	Low	[0–1]	1
	Moderate	[2–21]	13
	High	[22–110]	24
Average Number of Jobs	Low	[0–222]	11
	Moderate	[223–606]	11
	High	[607–14,047]	17
Population of Males (25–34 years)	Low	[0–65]	19
	Moderate	[66–143]	12
	High	[144–1,585]	8
Number of Households	Low	[0–306]	16
	Moderate	[307–633]	15
	High	[634–2,829]	6
Residence Area Characteristic	Low	[0–318]	15
	Moderate	[319–676]	17
	High	[677–3,561]	6
Work Area Characteristic	Low	[0–59]	8
	Moderate	[60–506]	10
	High	[507–27,382]	20

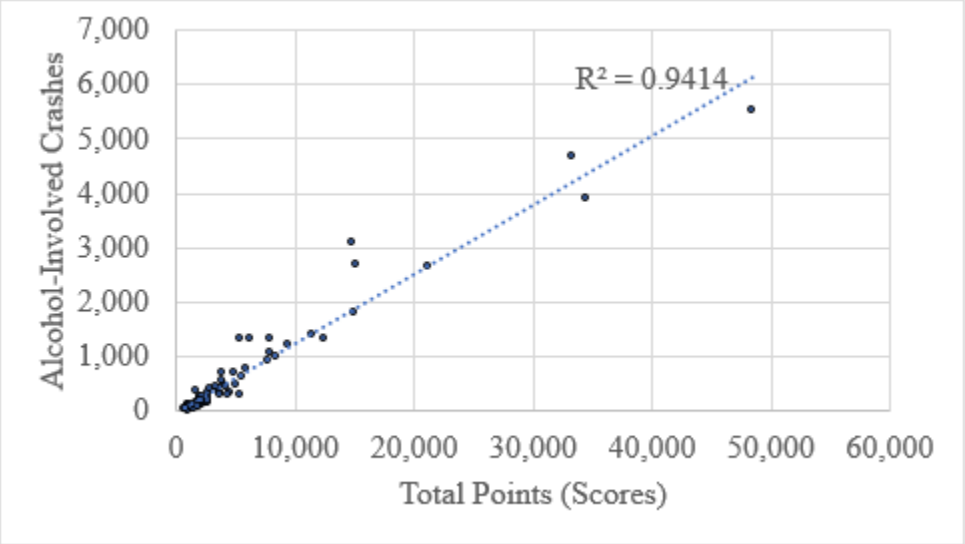
The number and percentage of block groups with the three risk levels in each parish is displayed in Appendix I. However, as an example, in Acadia, 12 of 47 block groups were identified as having high risk of KA alcohol-involved crashes, whereas in Allen, 3 out of 18 block groups were identified as having a high risk of KA alcohol-involved crashes. The total points of each parish are also listed in Appendix I. In East Baton Rouge, the total points of the 303 block groups equaled 33,335. Higher total points indicated an overall higher risk of alcohol-involved crashes.

Evaluation of the Systemic Assessment Performance. The assessment results of all alcohol-involved crashes (i.e., KABCO) are documented in Appendix H. Overall, the risk factors showed the same effect in both KABCO and KA alcohol-involved crashes. For example, the weight points of on-site alcohol sellers in KA alcohol-involved crashes were 6, 13, and 20, corresponding to low, medium, and high, respectively. In the systemic analysis using KABCO alcohol-involved crashes, the weight points were 4, 12, and 23, respectively. In both severity levels, as the number of on-site alcohol sellers increased, the points also increased (i.e., higher risk of alcohol-involved crashes).

To understand the association between key variables and parish-level total points (from the block-group-level systemic analysis), a table, displayed in Appendix I, was developed containing the important measures and total points assigned for each parish and measure from the block group systemic analysis. The top three parishes with the highest total points were Orleans, Jefferson, and East Baton Rouge, respectively. The total points were developed based on demographic and other significant variables. This approach offers a more intuitive predictive measure than conventional hotspot analysis. For example, Jefferson Parish had 34,502 total points. This parish experienced 139 alcohol-involved KA crashes during 2013–2018. Three other parishes (Caddo, Calcasieu, and Lafayette) had higher alcohol-involved KA crashes than Jefferson but also had lower total points. This finding indicates that systemic analysis provides data-driven risk measures rather than reactive methods (for instance, the hotspot analysis and counts of historical data methods can be applied only when certain numbers of alcohol-involved crashes have occurred in the area).

The scatterplot shown in Figure 13 illustrates the total points and alcohol-involved crashes (at the parish level). Total points and alcohol-involved crashes were highly correlated ($R^2 = 0.941$). This finding illustrates that the risk factors and developed risk scores could predict the number of alcohol-involved crashes. Among the outliers, five of the parishes represent metropolitan areas, namely in the areas of New Orleans (Orleans Parish), Shreveport and Bossier City (Caddo Parish), Lake Charles (Calcasieu Parish), Baton Rouge (East Baton Rouge Parish), and Kenner/Metairie (Jefferson Parish). These statistics likely reflect population density. Interestingly, two metropolitan areas of the state were not addressed in these statistics, namely Alexandria (Rapides Parish) and Monroe (Ouachita Parish).

Figure 13. Total points versus alcohol-involved crashes



Results for General Population Survey (Task 3)

The objective of Task 3 was to create and administer a survey based on information from the literature review (Task 1) and data analysis (Task 2). The overarching goal of the survey was to assess knowledge, attitudes, behaviors, and cultural aspects related to drinking and driving in Louisiana and how to reduce the behavior and improve roadway safety. The research team developed a self-administered survey and delivered it to participants online. The research team analyzed the survey data using descriptive statistics. Selected findings are presented below. The data can be viewed in aggregate via the online tool (see Appendix J).

Demographics

Respondents to the survey were 55 percent female and 44 percent male. The majority were young adults, 60 percent of whom were between the ages of 21 and 35 years. Very few respondents were over age 65 years (less than 1 percent). Over half of the respondents (56 percent) were married, and nearly two-thirds (65 percent) had a college degree or higher education. The majority identified with the Catholic religion (38 percent), followed by Protestant (19 percent), Christian (4 percent), Baptist (2 percent), and other (7 percent). Approximately 26 percent indicated no religious affiliation, with an additional 3 percent stating they did not want to specify their religious affiliation. The majority (61 percent) of respondents reported being employed full time,

with an additional 8 percent reporting being employed part time. Ten percent of respondents identified as being students. The most common vehicle driven was a passenger car (48 percent), followed by an SUV (28 percent) and pickup (11 percent).

The demographic profile of respondents is comparable to the state overall based on data from the 2019 ACS 5-year estimate [74], but the survey was limited to individuals 21 years of age and older. Key differences include a larger representation of individuals under age 45 years, a higher proportion of individuals of Hispanic origin, a higher proportion of married individuals, and a higher proportion of highly educated individuals.

Table 18 presents the comparative data.

Table 18. Demographic comparison for Louisiana survey and census

Variable	Louisiana Survey	Louisiana Census	
Age			
<21 years	0%	<20 years	26.1%
21–25 years	17.1%	20–24 years	6.8%
26–35 years	43.3%	25–34 years	14.3%
36–45 years	24.0%	35–44 years	12.5%
46–55 years	11.0%	45–54 years	12.3%
56–65 years	4.4%	55–64 years	12.9%
66+ years	0.2%	65+ years	14.9%
Gender			
Male	44.2%	48.2%	
Female	55.1%	51.8%	
Non-binary/unknown	0.7%	N/A	
Race			
African American/Black	23.4%	32.2%	
Asian	4.1%	1.7%	
White	69.6%	62.0%	
Combination	1.2%	2.0%	
Other/unknown	1.7%	1.4%	
Hispanic origin	15.6%	5.1%	
Relationship status		Males	Females
Married	55.7%	45.4%	41.6%
Single	36.0%	38.8%	32.9%
Divorced (Separated)	6.3%	12.7%	15.6%
Widowed	0.7%	3.0%	9.8%
Unknown	1.2%	N/A	N/A
Educational attainment			
No degree	—	No degree	15.2%
High school or less	8.5%	High school	34.0%
Some college	25.1%	Some college/Assoc degree	27.1%
College graduate	43.6%	Bachelor’s degree	15.5%
Advanced degree	21.2%	Grad/prof degree	8.2%
Unknown	1.7%	Unknown	N/A

Note: N/A = not applicable.

Residential Area

Respondents reported living in areas across Louisiana. The top three parishes were Orleans (10 percent), East Baton Rouge (9 percent), and Lafayette (7 percent). The top three safety coalition regions were Capital (19 percent), New Orleans (17 percent), and Acadiana (14 percent). These three regions were followed by Northwest (10 percent), Northeast (8 percent), North Shore (8 percent), Southwest (7 percent), South Central (6 percent), Central Louisiana (6 percent), and Unknown (5 percent).

Alcohol Consumption Patterns

In terms of the age when drinking began, 47 percent reported having their first sips of alcohol (other than for religious reasons) when they were under the age of 18 years. Another 24 percent reported their first sips between the ages of 18 to 20 years. A large proportion (35 percent) also reported having been drunk for the first time when they were under 18 years old, with an additional 28 percent reporting their first drunk episode at age 18 to 20 years. Overall, a high proportion (70 percent) of respondents reported consuming alcohol within the past 30 days. As a comparison, a recent national survey that included Louisiana suggested lower levels—55 percent nationally and 52 percent for Louisiana [75].

Drinking Alcohol and Driving in Louisiana

A variety of survey items assessed attitudes and behaviors regarding drinking alcohol and driving in Louisiana. Compared to three years ago, 44 percent perceived the problem of driving after drinking in Louisiana to be the same, with an additional 35 percent reporting that the problem is somewhat or much bigger. Overall, more of the older age groups perceived the problem to be improving compared to three years ago (data not shown).

Overwhelmingly, respondents reported disapproving of driving after drinking enough alcohol to be over the legal limit (68 percent for males and 76 percent for females). A similar pattern was observed for opinions regarding driving after drinking but not being over the legal limit (30 percent of males and 36 percent of females). However, nearly half (49 percent) of males and a third (33 percent) of females reported driving after drinking enough alcohol to be over the legal limit in the past year.

Forty percent of respondents reported driving within two hours of drinking in the past year. The majority of respondents who reported driving within two hours of drinking indicated that the location where drinking occurred on the most recent occasion was most often at a family or friend’s home (40 percent of males; 43 percent of females), followed by a restaurant, bar, or club (24 percent of males; 33 percent of females) and own home (22 percent of males and 17 percent of females). The pattern was similar across all age groups except for 21 to 25 year-olds and 46+ year-olds, who reported drinking at a restaurant, bar, or club more than at their home compared to those 26 to 45 years old.

Regarding the amount of time from the last drink to starting to drive (most recent event for those who drank and drove within two hours), 20 percent of males and 15 percent of

females reported driving while drinking, with an additional 31 percent of males and 22 percent of females reporting driving within 30 minutes of their last drink.

Deciding Not to Drive after Drinking

About half of the respondents (55 percent) reported deciding not to drive after having consumed alcohol in the past year. Of those individuals who avoided driving, the most common methods used were family or friend (31 percent) and a rideshare company like Uber or Lyft (27 percent). The younger age groups more often reported using a rideshare company, while older age groups more often reported using a taxi (data not shown). Approximately 64 percent of respondents reported trying to stop someone who had too much to drink from driving during the most recent time they tried to do so. Of these respondents, 39 percent reported that the person drove anyway.

Trip Planning

Trip planning involves arranging for safe transportation ahead of time when someone knows that he or she will be going out and drinking alcohol. Regarding trip planning, 51 percent of respondents reported always planning their ride when they know they will be drinking. Approximately 57 percent of females reported always planning their ride, compared to 43 percent of males.

The most commonly reported modes selected when trip planning were a rideshare company such as Uber or Lyft (49 percent of males; 45 percent of females), a designated driver (42 percent of males; 61 percent of females), and a friend or family member who was not a designated driver (30 percent of males; 37 percent of females). A smaller proportion of males (15 percent) and females (14 percent) still planned on driving.

Rideshare companies are increasingly promoted as a means of preventing drinking and driving, but some people find barriers to their use. A large proportion (42 percent of males; 31 percent of females) reported that using a rideshare company was not hard. However, lack of access to Uber or Lyft at their residence was an issue for 17 percent of males and 14 percent of females. Lack of a cell phone was low, at 2 percent of males and 1 percent of females, but the cell phone application being hard to use was an issue for 8 percent of males and 3 percent of females. Cost was an issue for 22 percent of males and 24 percent of females. Wait time was an issue for 25 percent of males and 18 percent of females. Safety concerns were an issue for 17 percent of males and a much larger proportion of females (35 percent).

High-Risk Areas and Events

Many respondents perceived that festivals, parades, sporting events, and universities and colleges are specifically high risk. The following describes the percentage of respondents who strongly agreed or somewhat agreed that drinking and driving was common at each event or location: festivals or parades (85 percent), sporting events (83 percent), universities or colleges (77 percent), seafood processing (36 percent), military (35 percent), and oil and gas fields (33 percent).

With respect to specific festivals, the most frequently endorsed were Mardi Gras (74 percent), New Orleans Jazz and Heritage Festival (53 percent), French Quarter Festival (48 percent), Voodoo Music and Arts (44 percent), and Bayou Country Superfest (40 percent). Interestingly, the highest-risk festivals are in New Orleans, and the Bayou Country Superfest (40 percent) transitions between Baton Rouge and New Orleans. Also, the lowest identified festival was the Natchitoches Lights Festival (10 percent), which is along the Cane River and has many hotels and bed and breakfast locations within walking distance, suggesting that proximity to hotels without the need for motor transportation may negatively correlate to perceived risk of drinking and driving.

Regarding the countermeasures that respondents felt most strongly would reduce drinking and driving at festivals and parades, the most commonly endorsed was access to free, safe rides (54 percent of males; 65 percent of females). Sobriety checkpoints were commonly endorsed by 50 percent of males and 55 percent of females. Increased access to rideshare companies (39 percent of males; 50 percent of females) and increased police visibility (34 percent of males; 38 percent of females) also were frequently endorsed, albeit to a somewhat lesser extent.

Sobriety Checkpoints and Other Countermeasures

Respondents provided their exposure to and opinion of sobriety checkpoints. Approximately 47 percent reported having seen a sobriety checkpoint in their community in the last year. Overall, 58 percent reported seeing or hearing a public service announcement (PSA) about sobriety checkpoints during the last year. Table 19 displays the percentages by safety coalition region.

Table 19. Frequency of seeing a sobriety checkpoint or PSA in the last year

Safety Coalition Region	Saw a Sobriety Checkpoint in Community in Last Year	Saw or Heard a PSA in the Last Year
Acadiana	44%	65%
Capital	42%	51%
Central Louisiana	67%	61%
New Orleans	35%	41%
Northeast	62%	74%
North Shore	45%	61%
Northwest	50%	67%
South Central	46%	63%
Southwest	62%	66%
Unknown	64%	64%

Overall, 58 percent of respondents supported conducting checkpoints weekly or monthly. Only 7 percent did not support checkpoints. Table 20 displays the proportion who indicated they somewhat or strongly support various approaches. The countermeasures endorsed most often were increasing the availability of free and safe rides (72 percent) and making treatment of alcoholism and alcohol abuse more available (73 percent).

Table 20. Frequency of support for different countermeasures

Countermeasure	Somewhat or Strongly Supportive
Requiring new cars to have built-in technology that won't let the car start if the driver's alcohol level is over the legal limit.	45%
Lowering the limit for driver's BAC from 0.08 to 0.05 g/dL.	32%
Having a law making it illegal to have any alcohol in your system while transporting a minor (person under 18 years).	55%
Increasing police and other law enforcement efforts to arrest drivers who are over the legal limit for drinking and driving.	59%
Providing people who have had too much to drink a FREE alternate way of getting home other than driving themselves.	72%
Making treatment for alcoholism and alcohol abuse problems more available.	73%
Increasing penalties for alcohol servers at licensed establishments when they let someone drive away drunk.	41%
Increasing penalties for party hosts whose guests drive away drunk.	34%
Implementing an open container law (not allowing people to have open containers of alcohol in public spaces).	31%
Limiting where hard liquor can be sold to only liquor stores.	27%
Asking elected officials to prioritize reducing drunk driving as a way to keep streets safe for drivers and passengers.	54%
Allowing restaurants and bars to be sued when they let someone drive away drunk who subsequently injures or kills someone.	30%

Driving While Intoxicated Penalties

Overall, there was some support for increased penalties for first-time DWI and repeat offenders. The largest proportion (69 percent) strongly or somewhat supported increasing fines for drivers repeatedly convicted of DWI, with the same percentage also endorsing increasing jail time or probation for these repeat offenders. A lower percentage, 55 percent, endorsed lowering the BAC limit for these offenders. Sixty-six percent endorsed requiring all drivers convicted of DWI, including first offenders, to use an ignition interlock device. Finally, 63 percent endorsed increasing license suspicion periods for any driver convicted of DWI.

Limitations of the General Population Survey

As with all surveys, key strengths and limitations should be acknowledged. The survey was not a random sample of the entire population of Louisiana. However, using MTurk allowed for the research team to reach many individuals from across the state with far fewer resources. Population-based surveys employing randomized methodologies also have high costs. The research team was able to collect detailed information from many respondents (N = 411) from across Louisiana. Overall, the demographic breakdown distribution was similar in the survey compared to the state. However, the survey respondents were more likely to be female and younger. Given that the subject of drinking and driving can be sensitive, another strength of MTurk is the ability for researchers to compensate participants while still maintaining their anonymity, which should increase the validity of responses.

Results for DUI/DWI Offender Survey and Stakeholder Interviews (Task 5)

Survey with DUI/DWI Offenders

Demographics. Table 21 displays the demographic profile for the survey. The sample was predominately male (67 percent), between the ages of 26 and 45 years (84 percent), White (72 percent), not of Hispanic origin (66 percent), married (69 percent), more than high school educated (85 percent), and employed full time (54 percent) or part time (16 percent). Regarding parish of residence, participants reported living in one of 31 parishes. Parishes with more than one participant included Acadia (n = 3), Allen (n = 4),

Ascension (n = 2), Avoyelles (n = 2), Bossier (n = 5), Calcasieu (n = 2), De Soto (n = 2), East Baton Rouge (n = 4), Jackson (n = 3), Lafayette (n = 2), Lincoln (n = 2), Livingston (n = 3), Orleans (n = 4), St. Tammany (n = 2), Tangipahoa (n = 4), and Vernon (n = 2). One participant each reported living in the following parishes: Bienville, Caddo, Catahoula, Claiborne, East Feliciana, Evangeline, Grant, Jefferson, Lafourche, Madison, Morehouse, Natchitoches, Rapides, Terrebonne, and Vermilion. In terms of their history of DUI or DWI, 57 percent reported having only one DUI or DWI, while the remaining 43 percent reporting having two or more DUIs or DWIs (data not shown).

Characteristics of the Most Recent DUI or DWI. Overall, the most recent charge was for alcohol only (67 percent) or alcohol and drugs (26 percent). Only 7 percent were charged with only drugs. About half were charged within the last year, with another 41 percent charged within 1 to < 5 years. The remaining proportion had been charged within 5 years or longer. The largest proportion (34 percent) reported having been drinking at a restaurant, bar, club, or movie theater before their most recent DUI or DWI. The next largest proportion (15 percent) reported drinking at home, with the same percent reporting drinking at Mardi Gras or a similar parade or event. An additional 11 percent reported drinking in their car or on the road, with an equal percentage reporting drinking at a wedding or other life event.

Table 21. Demographics of DUI/DWI offender survey participants (N = 61)

Variable	Percent
Gender	
Male	67%
Female	31%
Missing	2%
Non-binary	0%
Age	
21–25 years	9%
26–35 years	56%
36–45 years	28%
46–55 years	7%
56–65 years	0%
66–75 years	0%
76+ years	0%
Race	
White	72%
Black/African American	18%
American Indian/Alaskan Native	10%
Asian	0%
Native Hawaiian or Pacific Islander	0%
Multiple Races	0%
Other	0%
Hispanic, Latin(s), or Spanish Ethnicity	
Yes	34%
No	66%
Current Relationship Status	
Married	69%
Widowed	2%
Divorced	13%
Separated	2%
Single	15%
Education Level	
Less than High School	2%
High School Graduate	13%
Some College	28%
2-Year Degree	28%
4-Year Degree	23%
Professional Degree	7%
Doctorate	0%
Current Employment Status	
Employed Full Time	54%
Employed Part Time	16%
Self-employed	8%
Unemployed < 1 Year	8%
Unemployed for 1+ Years	7%
Active-Duty Military	0%
Retired	0%
Unable to Work	3%
Student	3%

The smallest proportion reported drinking at a sporting event (7 percent) or at a county club or golf course (5 percent). In terms of the perception of whether the individual was over or under the legal limit, 44 percent reported being just over the legal limit, with an additional 13 percent reporting being well over the legal limit. A considerable proportion reporting being just under the legal limit (20 percent) or well under (18 percent). Finally, 5 percent reported being unsure (data not shown).

In terms of the impact of the DUI or DWI, 54 percent reported subsequently using other types of transportation when they know they will be drinking, and 43 percent reporting having sought counseling. Another 43 percent reported stopping driving impaired or intoxicated. About 33 percent reported having lost their job (data not shown).

Finally, participants identified things that would have prevented their most recent DUI or DWI. About 52 percent identified access to a taxi and 43 percent identified access to a bus or trolley in their area. About 38 percent reported access to a ride service such as Uber or Lyft. The same proportion identified access to a cell phone with a ride service application and ability to contract a friend or family member for help. Access to a free ride program was also reported by 36 percent of participants (data not shown).

Prevention and Risk Factors for DUI or DWI. Regarding prevention or risk factors for DUI or DWI, 67 percent reported that their parents or other close family members or family friends drove while impaired or intoxicated when they were in grade school (data not shown). A similar proportion (57 percent) reported that someone is impacted by the behavior of parents or other close family and friends with respect to driving impaired or intoxicated (data not shown).

Regarding the reasons in general that people drive impaired or intoxicated, 61 percent reported that people do not realize how impaired they are, followed by 57 percent reporting that people do not think driving impaired is dangerous and 31 percent reporting that people do not have another ride home (data not shown).

Respondents identified events and locations where they agreed that drinking and driving was more common. The majority reported the problem being more common at festivals and parades (84 percent), universities and colleges (84 percent), and seafood processing (84 percent) to an equal degree. Next were oil and gas fields (72 percent), followed by military installments (69 percent) (data not shown).

Table 22 displays the frequency of support for various countermeasures designed to reduce drinking alcohol and driving. The most highly endorsed countermeasures were making treatment for alcoholism and alcohol more available (75 percent) and developing educational programs for parents (74 percent).

Table 22. Frequency of support for different countermeasures

Countermeasure	Percentage Strongly or Somewhat Support
Making treatment for alcoholism and alcohol abuse problems more available.	75%
Developing educational programs for parents on talking to their kids about driving impaired or intoxicated.	74%
Increasing sobriety checkpoints.	66%
Providing people who have had too much to drink a FREE alternate way of getting home other than driving themselves.	62%
Lowering the limit for driver's BAC from 0.08 to 0.05 g/dL.	59%
Increasing police and other law enforcement efforts to arrest drivers who are over the legal limit for drinking and driving.	59%
Requiring new cars to have built-in technology that won't let the car start if the driver's alcohol level is over the legal limit.	57%

Table 23 displays support for countermeasures that target drivers convicted of DUI or DWI. The most frequently supported countermeasure was increasing fines for repeat offenders (72 percent), followed by increasing license suspension periods (66 percent) and requiring all convicted offenders to use ignition interlock devices (62 percent).

Table 23. Frequency of countermeasures targeting drivers convicted of DUI/DWI

Countermeasure	Percentage Somewhat or Strongly Supportive
Increasing the severity of fines for drivers who are repeatedly convicted of DWI.	72%
Increasing license suspension periods for any driver convicted of DWI.	66%
Requiring all drivers convicted of DWI (even first-time offenders) to use a device that won't let their car start if they have been drinking.	62%
Lowering the BAC limit for drivers who are repeatedly convicted of DWI.	57%
Increasing jail time or probation time for drivers who are repeatedly convicted of DWI.	54%

With respect to the role that employers could play in prevention, a majority (79 percent) noted that employers could help their employees avoid driving impaired or intoxicated. For instance, 39 percent reported that employers could create a ride-home program. About 26 percent noted that employers could provide educational materials about impaired driving. About 10 percent reported that employers could refer alcohol or drug counseling services (data not shown).

Offender Survey Limitations. One key limitation of the survey was that it was not a random sample of the entire population of DUI and DWI offenders in Louisiana. However, using a nearly anonymous survey allowed the research team to reach a vulnerable and hard-to-access population. Using the online approach, the research team was able to collect information from a reasonable number of respondents (N = 61) across Louisiana. Overall, the demographic breakdown distribution was similar to what may be expected for those charged with DUI or DWI. However, it was impossible to confirm that respondents had a prior charge of DUI or DWI. In addition, the survey was administered during the COVID-19 pandemic, which could have increased or decreased high-risk behaviors and their detection.

Structured Interviews with DUI/DWI Stakeholders

Across the six professions represented in the structured interviews with DUI or DWI stakeholders, key themes were identified despite different experiences with offenders and different levels of expertise. Complete interview responses are provided in Appendix D.

The structured interviews revealed that individuals with DWI and DUI typically had a history of substance abuse prior to their charges. In addition, men had a greater likelihood of having a DWI or DUI than women, but DWI and DUI charges were increasing among women.

In terms of demographics, men in their early 20s and in their 50s were more prevalent DUI and DWI offenders. Women charged with DUI or DWI were more diverse in age. Many of the professionals interviewed noted that individuals working in the oilfield often had substance abuse issues that could lead to DUI and DWI offenses. Some noted that when young males working in the oilfield earn high wages, they may be more likely to engage in high-risk behaviors.

Regarding biographical and cultural factors, interviewees identified two critical ages related to substance abuse: the age that people started using alcohol and the age that they began using drugs. For the latter, DUI/DWI offenders tended to begin using drugs by age 16 to 19. However, for some, alcohol use began at 12 to 13 years and then drug use began at 15 to 16. Thus, there was agreement among interviewees that 16 is the age when drinking started for those with DUIs or DWIs.

Across most interviewees and professional groups, there was a belief that Uber and Lyft can be pivotal in reducing drinking and driving. Many noted that these services are

expensive and not accessible to everybody. Consequently, limited financial resources may play a role in DUI and DWI.

Many interviewees across multiple professions noted that too much emphasis is placed on final behaviors, namely drinking and driving (the proximate cause of DUI and DWI), as opposed to addressing true prevention by discouraging individuals from drinking too much in the first place (the root cause). Prevention needs to address family history and local cultural norms.

Finally, multiple interviewees noted the largely unknown, but potentially significant, impact of the legalization of marijuana on both policy and enforcement, especially as it relates to impaired driving (DUI and DWI).

Structured Stakeholder Interview Limitations. The sample size for the structured interviews with DUI and DWI stakeholders was limited by time and resources given that individual interviews are time intensive. In addition, identifying and recruiting participants can be time consuming and difficult. Despite these challenges, a wide range of professional stakeholders representing six different professions were included from across Louisiana. The approach ensured that a diversity of perspectives would be collected if they existed.

Conclusions

This section presents the study conclusions based on all tasks performed.

The literature review followed a question-and-answer approach for initial identification of cultural groups (i.e., gender, religion, economical background) and then examined how different cultural groups approach age of first consumption, consistent alcohol usage, and binge drinking. Information from the literature review was the foundation for the statistical analysis but also informed the surveys and structured interview process.

Researchers found several significant demographic, cultural, and religion-based factors at the parish level that may contribute to the occurrence of alcohol-involved crashes. The findings at the parish level indicate that being Protestant, older, and afforded more protective factors against at-risk behavior in youth are linked with decreased alcohol-involved crashes. The interactive tool (https://ladotd.shinyapps.io/LA_Alcohol_Tool/) provides a range of parish-level data and allows the user to overlay alcohol-involved crashes to evaluate the interrelationship between parish-specific cultural and relevant features and alcohol-involved crashes.

The systemic analysis, conducted at the block group level, provided added granularity to identify risk locations at a level lower than the parish. Compared to conventional hotspot analysis based on observed crash data, systemic analysis develops predictive measures of risk assessment that might serve as a better risk indicator for future crash events. Instead of relying solely on observed crashes, systemic analysis provides more insight based on associated variables. Researchers identified the top 50 block groups using this approach, which assigned weights to block groups based on factors that are overrepresented in alcohol-involved crashes. The top traits for block-group-level analysis were number of arrests, intersections, alcohol sellers (both on site and off site), and jobs. Additionally, parishes were associated with block-group-level risk measures to provide additional information on the larger spatial units.

The findings from the literature review (Task 1) and parish-level and block-group-level analyses (Task 2) collectively identified potentially high-risk geographic areas for alcohol-involved driving. In addition, Task 1 and Task 2 helped identify topic areas where data were not readily available for Louisiana.

The survey (Task 3) indicated that while most respondents (68 percent of males; 76 percent of females) disapproved of drinking and driving, many self-reported drinking and driving themselves, and some even drink while driving. Many also perceived the problem of drinking and driving as worsening. This perception was especially prevalent among the youngest cohort (21 to 25 years). This youngest group was also the most likely to have used Uber/Lyft recently and to frequently plan to use Uber/Lyft (surpassing *family* or *friend* as an option), even though cost and safety concerns (especially among female respondents) were issues. However, this group was the least likely to use a taxi.

Trip planning was implied in the youngest group's relatively greater likelihood of using rideshare companies regularly. As noted above, the relationship between trip planning using TNCs and alcohol-impaired driving (and the associated crashes) is somewhat ambiguous for Louisiana. Half (51 percent) reported always engaging in some form of trip planning when they also planned to drink. Although the understanding of the underlying mechanism of trip planning can benefit from additional research, making alternative transportation modes more attractive and more readily available—thereby encouraging planning ahead (trip planning)—can potentially reduce drinking and driving.

More proactive interventions and preventive measures like sobriety checkpoints received some support, especially when paired with events and festivals. Strong support also existed for addressing identified barriers to driving after drinking alternatives, such as eliminating costs (with free rides), improving rideshare safety, and even increasing medical/public health intervention availability, such as alcohol treatment. In general, these proactive measures were more strongly supported by older age groups.

The DUI/DWI offender survey and stakeholder interviews (Task 5) confirmed many of the findings from the literature review (Task 1), data analysis (Task 2), and general population survey (Task 3). Most notably, both the stakeholder interviews and the DUI/DWI offender survey confirmed the tendency for DUI or DWI offenders to have a history of substance abuse prior to their DUI or DWI charges. Both also corroborated literature showing a higher prevalence of males in their 20s and 50s among DUI and DWI offenders.

In addition, both groups (offenders and stakeholders) identified the importance of family history and cultural traditions related to alcohol use as important factors in attitudes about drinking in general and DUI/DWI-related behaviors specifically. The stakeholder interviewees also recognized these as significant challenges for intervention programs and professionals.

Both the stakeholder interviews and the DUI/DWI offender survey confirmed the potential for improved Uber/Lyft availability and affordability to reduce alcohol-related impaired driving. (Lack of a cell phone with a ride service application was associated with Uber/Lyft access as a preventive measure by the offender survey group. Taxi service does not have this association with cell phones and may represent a separate population of offenders. However, both cited the availability of alternative transportation options as an important preventive measure.)

Finally, the stakeholder interview respondents distinguished between the underlying cause of DUI/DWI-related behavior (excessive alcohol consumption) and the behavior itself (drinking and driving). While this is a fundamental aspect of the problem, it was recognized as especially difficult to address since it is rooted in local culture and tradition. In this context, the age of first consumption of alcohol is considered critical. This distinction was alluded to by the offender survey respondents, but only indirectly.

Recommendations

Based on study findings, the research team recommends the following:

1. Maintain and enhance existing information about the interplay between drinking, driving, and culture. Information about drinking, driving, and culture is more dynamic than static. Stakeholders in Louisiana should continue data collection and revise analyses to reflect ongoing trends.
2. Use the web tool for systemic assessment and continue to develop GIS mapping initiatives to understand both geographic and cultural influences on drinking and driving. The web tool for systemic assessment developed within the current study provides a novel approach to understand cultural features affecting drinking and driving. A key benefit of the web tool is that it screens the state to identify locations where high-risk factors and alcohol-involved crashes concentrate, as opposed to hotspot crash analyses that focus solely on crash frequency and not exposure measures or other key factors. The tool not only provides materials for researchers but also offers a teaching resource for police officers and counselors-in-training. Additionally, mapping can be used to localize funding for checkpoints and allocate counseling funds.
3. Promote *culture* as a continuous factor for examination to better understand the connection between drinking and driving. Sometimes, curtailment efforts focus on locations or areas without a complete understanding of cultural differences associated with drinking and driving. Understanding cultural differences can have a far-reaching impact, particularly on educational outreach.
4. Recognize that drinking and driving is not exclusively an urban problem, and rural communities require special attention. This study demonstrated that drinking and driving is not limited to urban parishes; rather, it is particularly problematic in rural parishes, such as Avoyelles, Grant, and Cameron parishes.
5. Recognize that drinking and driving is problematic north of Rapides Parish. Louisiana is often dichotomized: drinking Catholics in the south and abstinent Protestants in the north. While some of these generalizations have merit, several corridors of the state are problematic, especially the corridor between Marksville and St. Joseph. These areas have many cultural features that might be linked to increased drinking and driving, including large numbers of agriculture or oil industry workers and economically impoverished communities. The present study

findings provide an opportunity to further examine cultural features that differ between the northern and southern parts of the state as they relate to the propensity to drink and drive.

6. Identify and promote multiple transportation modes to empower individuals who have been drinking and driving to safely get home. Participants in the surveys and structured interviews consistently indicated that multiple transportation options, such as Lyft and Uber, are needed. However, several of these options are expensive. Outside of New Orleans, in which trolleys operate non-stop, no city offers public transportation after 10 p.m. Because drinking activities primarily occur after 10 p.m., creative options are needed, especially relating to funding and expanding transportation modes for rural communities, which are often faced with limited resources.
7. Enhance public education campaigns about the dangers of drinking and driving. Drunk driving educational outreach currently exists along the I-10, I-20, and I-49 corridors. The following issues should be considered when designing further outreach.
    a. Oilfield and seasonal workers should be considered for targeted outreach and education.
    b. Specialized education should focus on young white males.
    c. People should understand that "buzzed" driving reflects drunk driving.
    d. Moderation campaigns should be informed by, and promoted in the context of, regional culture.

Acronyms, Abbreviations, and Symbols

Term	Description
A	Incapacitating Injury (Crashes)
ACS	American Community Survey
B	Non-incapacitating Injury (Crashes)
BAC	Blood Alcohol Concentration
BRFSS	Behavioral Risk Factor Surveillance System
C	Possible Injury (Crashes)
CCYS	Caring Communities Youth Survey
CORE	Core Alcohol and Drug Survey
DUI	Driving under the Influence
DWI	Driving while Intoxicated
FHWA	Federal Highway Administration
H	Households
K	Fatal (Crashes)
DOTD	Louisiana Department of Transportation and Development
LEHD	Longitudinal Employer-Household Dynamics
LTRC	Louisiana Transportation Research Center
MoDOT	Missouri Department of Transportation
NHTSA	National Highway Traffic Safety Administration
OD	Origin-Destination
PDO or O	Properly Damage Only or No Injury
PSA	Public Service Announcement
PTSD	Post-Traumatic Stress Disorder
RAC	Residence Area Characteristic
TNC	Transportation Network Company
TRID	Transport Research International Documentation
VMT	Vehicle Miles Traveled
WAC	Work Area Characteristic

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Appendix A

Table 24. Listing of data sources pertaining to alcohol-involved driving in Louisiana

Data Source	Years	Level	Topics	Population	Notes
Behavioral Risk Factor Surveillance System (BRFSS)	2012–2016 (some items go back as far as 2001)	State	Alcohol use, drug use, drinking and driving, risk behaviors	Adults	Picard
Caring Communities Youth Survey (CCYS)	2006, 2008, 2010, 2012, 2014, 2016 (some items go back as far as 2006)	Parish	Alcohol use, drug use, drinking and driving, risk behaviors	Grades 6, 8, 10, 12	Picard
Alcohol Epidemiological Data System	1999–2016	State	Per capita number of gallons of alcohol sold/purchased annually	Not applicable	Picard
Core Alcohol and Drug Survey (CORE)	2009–2017	Regional	Alcohol use, drug use, drinking and driving, risk behaviors	College age	Picard
LA Office of Public Health, Center for Records and Statistics	2001–2004, 2005–2008, 2009–2012, 2013–2016	Parish	Chronic liver disease deaths	Total population	Picard
LA Dept. of Education	2004–2008	Parish	School indicators	School-age population	Picard
Highway Safety Research Group (HSRG)	2005–2017	Parish	Number and rate of arrests of driving while intoxicated that are confirmed by breathalyzer test with a BAC of 0.08	Total population	Picard
Longitudinal Employer-Household Dynamics (LEHD)	2012–2017	Block Group	Jobs	Total population	LEHD
American Community Survey (ACS)	2012–2017	Block Group	Demographics	Total population	Census

Data Source	Years	Level	Topics	Population	Notes
Population and Demographics	2016	Parish	Median income, housing units, self-reported excess alcohol use, race/ethnicity percentages, population 65 and over, population under age 18	Total population	LA Dept of Health — Health Data Portal
LA Crash Data	2013–2018	Point	All crashes	Total population	DOTD
LA Driving While Intoxicated (DWI) Arrests	2015–2018	Point, Parish	All arrests	Not applicable	LA Highway Safety Commission Office
LA Alcohol Outlets	As of 10/29/2018	Point	All alcohol outlets/on and off sale	Not applicable	LA Office of Alcohol and Tobacco Control
LA Roadway Inventory Data	Current version	N/A	Roadway features	Not applicable	DOTD
Festivals	Current version	State	Dates of major festivals	Not applicable	Picard/other
Oil Wells	Current licenses	Point	Not applicable	Not applicable	Sonris
Religion Statistics	2010	Parish	Religion attendance	Total population	Internet—homefacts.com
Military Bases and Installments	Current	Point	Location of military bases and installments	Not applicable	Military websites

Note: N/A = not applicable.

Appendix B

To obtain a copy of this appendix in full, please contact principal investigator Eva Shipp at E-Shipp@tti.tamu.edu or project manager Elisabeta Mitran at Elisabeta.Mitran@la.gov.

Appendix C

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Appendix D

Detailed Responses from the Structured Interviews with DUI and DWI Stakeholders

Police Officers Responses (n=3)

1. In your agency, approximately how many or what percentage of traffic stops or even arrests are for DWI or DUI offenses? What proportion or how many are not alcohol involved/strictly drugged-only driving offenses?

Responses: 15%, 20%, less than 30%

2. For individuals with DWI or DUI offenses, what are common behaviors on the roadway that officers like you have seen?

    a. Improper lane change

    b. Speeding

    c. Failure to yield

    d. Failure to stop at a stop sign or light

Responses: All of these have been observed

3. What are the main challenges that officers face when determining if a driver may be impaired? Is this different for someone suspected of being impaired due to alcohol versus drugs?

Responses:

“Time of day, such as night or day makes a big difference. Obviously, more offenses occur at nighttime.”

“Cell phone versus DWI is often difficult to determine the difference. Cell phone may copy behaviors of DWI, interesting.”

“Alcohol and drugs have different parameters. Alcohol more measureable.”

“I am concerned about what will happen when pot becomes legal. I have training on differences, but looking at straight driving behavior, hard to distinguish.”

4. In your professional opinion, what could improve the enforcement of laws prohibiting drinking and driving?

Responses:

“Until specific measure for drugs, will be difficult to evaluate drivers.”

“Less loop holes allowing drivers to avoid charges.”

“Not able to see charges until the end. Limited role. Only can assist with identification, not prosecution.”

“More money needed for overtime. Festivals especially.”

5. In your patrol area, is the frequency of drinking and driving associated to any local festival participation or sporting event? Which ones?

Responses:

“Of course, festivals create a special set of circumstances.”

“Many individuals are aware of checkpoints and make arrangements.”

“Most activities are during the day, and most festival goers will go to festival during the day and then drink at their homes at night.”

“Mudbug Madness” Shreveport

“Mardi Gras” New Orleans

6. In your patrol area, what is the frequency that someone may be pulled over for this type of offense when they have gotten off work within the last 2-3 hours?

Responses:

“Difficult to determine.”

“Can’t even estimate.”

“Maybe 10%, difficult question to answer.”

7. In your patrol area, are drinking and driving arrests concentrated or often associated with the oil and gas industry, the military, or other activities or factors?

Responses:

“I know when people get off the rigs. Land-based rigs need special attention.”

“There are special bars that oilfield workers go to. You always need to be aware of who is there. I can work with Bar Owner because they know they will get in trouble if too many offenses.”

“With change in oil prices the assumption that less drinking will occur is wrong. In fact, several seem to drink harder, make poorer decisions, and this creates problems for me.”

8. How do officers monitor the progress of legal proceedings for individuals with DWI or DUI charges? Is it different for individuals with drugged-driving charges?

Responses:

“I am concerned about how marijuana will affect my job.”

“District Attorneys keep in touch with me, as I am an important part of their case.”

“Good paperwork and documentation and testing makes my work relatively easy.”

“Assistant District Attorneys keep me up-to-day relatively easily.” [sic]

“Prefer not to answer the question.”

“We need more training about drug charges.”

“Too many drugs and too many behaviors with each drug.”

9. Most often, when individuals are suspected of drinking and driving, do they offer excuses or justifications for why they were drinking and driving? If so, what are they?

Responses:

“Anything and everything.”

“Women tend to think that crying will get them out of a DUI. With men, it is just sad when they cry.”

“I only had one beer.”

“I can only get a DUI with alcohol. People don’t realize they can get charged for drugged driving.”

10. Particularly with DWI and DUI offenses, do individuals often reflect or indicate this is the first time that they have driven while drinking?

Responses:

“All the time. Everyone has an excuse. I am thankful for testing.”

“I do think that some folks truly rarely drink and they do get caught the one on the few times that they drink. However, that same person is impaired and can cause serious damage or get into a wreck. I have to treat all the same.”

“For women, I think they tend to drink less and make the single fatal mistake. For men, particularly teenage boys and men in their late 50s, it isn’t a matter of just their first time drinking and driving. Rather, it is the first time they got caught.”

11. For these same individuals, do these individuals tend to acknowledge that they have been arrested previously for the same type of charge, or they have multiple offenses?

Responses:

“Same as before.”

“Seems like the same question as before.”

“Unfortunately for some. They have 2-3-4 offenses. Often they can get off for technicalities, or the perceived risk versus benefits geared towards most likely not likely to get caught.”

12. For new police officers or individuals that want to enter your field of work, particularly wanting to work with DWI and DUI offenders, what recommendations would you have for these aspiring officers?

Responses:

“Learn about the different types of behaviors for the different types of drugs. While impairment is impairment, you need to understand or predict what people will do. However, recognize if someone has multiple drugs in their system, they may have a wide range of predictable and unpredictable behaviors.”

“There is a balance between sympathy, empathy, and following the law. You want to have a good heart, but recognize that impaired drivers can cause some serious damage and kill people. A hard hand is always needed.”

“Recognize that being a police officer is a culture. People do not often recognize that. A good officer is most often not liked by others. Also, learn to get along with fellow officers.”

13. Based on your professional experience, are there policy, legislative, or procedural recommendations you would offer to policy makers or government officials, or even researchers, to help curtail, reduce, or eliminate the occurrence of drinking and driving?

Responses:

“Increased checkpoints will always help out.”

“Overtime is always needed.

“Uber and Lyft access needs to increase.”

14. Based on your professional experience, do you have any other suggestions for how to prevent drinking and driving?

Responses:

“Uber, Lyft, and have additional options for the drinking driver.”

“We tend to assume that drunk drivers need a ride home. Why can’t we simply prevent individuals from drinking too much. I am for individuals having the freedom to drink, but shouldn’t they have the responsibility to simply not drink too much.”

“Uber, Lyft, and more checkpoints.”

“The idea of having 2-3-4 times to make a mistake such as drinking and driving is ridiculous. People assume they can get off if they make a mistake.”

Probation Officers (n=4)

1. In your agency, approximately how many on probation or parole have incurred prior DWI or DUI offenses? Do you know if any of the individuals that you monitor that concurrently have a DWI or DUI offense involving/strictly drugged-only driving offense?

Responses:

“Most folks I work with have some history of substance abuse. My clients may not have a DUI or DWI but they have most often have a history of some type of substance abuse.”

“Very few do not have some type of substance abuse history.”

“More often than not, the Probation folks have some type of substance abuse history. Some have it under control, and if not, they are receiving some intervention.”

“Getting this information is important. They will need to participate in treatment if this is a problem. They will not be successful if substance abuse remains a problem.”

“Even if treatment is provided, most often, unfortunately, treatment does not stick. It may happen or may not happen, I mean successfully not drinking and driving.”

“Drugs offer additional challenges, particularly for drinking and driving. This will be difficult particularly for police officers.”

2. For individuals with DWI or DUI offenses, what are common concurrent past or current charges? For example:
    a. Robbery
    b. Assault
    c. Drug charges
    d. Other charges

Responses:

“All of the above.”

“Rare for someone to just have one offense. However, most often DWI not concurrent with most folks.”

“Assault and drug addiction come together often, unfortunately. Also, people may commit crimes when intoxicated or drunk—they have poor decision making.”

“DWI is in another court. They don’t run across my desk. Other crimes are more frequent, but individuals I work with will have drug and alcohol abuse problems. Treatment is often concurrent with probation.”

3. As a Probation Officer, do you often incur individuals with drug or alcohol use problems while under your supervision? Do these individuals tend to participate in formal treatment, or most often attempt to address or deal with their addiction without formal treatment, such as AA or NA?

Responses:

“If it is a problem they need to receive treatment. At times treatment may be pressed, but if pressed, it at times will not be successful.”

“Drug testing is required. If a problem, treatment is required.”

“Formal treatment is expensive. AA and NA are cheaper alternatives.”

“We have good community support and free or low cost treatment options. Development of relationships with the community is an important part of my job.”

4. In your professional opinion, what could improve the provision of treatment or intervention for individuals that you supervise or monitor?

Responses:

“If individuals have someone depending on them, such as kids, or a wife, treatment is more productive, at least in my opinion. If someone sees that this is the last option before prison, then treatment will be good.”

“Personal responsibility and belief that individuals can change. If someone does not buy into treatment, they forced treatment will not be rehabilitated.”

“Definitely drug testing needs to continue. Without drug testing, people will not improve their lot in life.”

“More probation officers are needed. And, the use of churches and spiritual groups to assist with transition or even while someone is awaiting trial needs to continue. These groups make a big difference. I am not religious, but I tell you that if spirituality becomes a part of a person, people will make true changes.”

5. In your professional capacity, how often do the individuals that you supervise present positive for alcohol or drugs while under your supervision?

Responses:

“If you are in trouble, you have experience with the bottle or drugs, or both. Few are very simple crimes in which no one has a background in drugs or alcohol.”

“It is rare for someone to not have a background with alcohol or drugs.”

“If I am seeing you, I will give you the benefit of the doubt, but for most—there is a history of alcohol and/or drugs.”

“There is a difference between testing positive now versus having a past history. We do consistent drug screens. If someone is positive, we know.”

6. In your professional capacity, particularly for individuals with past drug or alcohol problems, with or without DUI or DWI offenses, what primarily are their educational backgrounds?

Responses:

“It varies, hard to determine.”

“Now, increasingly I am beginning to have more individuals with college degrees. People with no money make very bad decisions, including crimes.”

“There is a relationship between no money and bad decisions. I do tend to see a bunch of people that have several generations of bad decisions. Those generations tend to not have

consistent education. Most folks have high school education or less, but don't make assumptions."

"People with college degrees will make bad decisions, but often they are also able to get good attorneys, which they will not see me. Economics definitely prompt people to make bad decisions, such as theft."

7. In your professional capacity, particularly for individuals with past drug or alcohol problems, with or without DUI or DWI offenses, what primarily are their vocational or work backgrounds?

Responses:

"I will get several folks from the oilfield."

"A wide range of individuals will be seen on a daily basis."

"More recently, there are several individuals in the restaurant industry getting in trouble for drugs. The restaurant culture is changing in my opinion. Especially pills in restaurants—college aged kids working in restaurants and doing drugs."

"Oilfield, restaurants. However, I get a lot of folks from different backgrounds."

8. In your professional capacity, particularly for individuals with past drug or alcohol problems, with or without DUI or DWI offenses, what primarily are their ages?

Responses:

"Males tend to be in their teens or 20s and 50s. Women tend to be in their late 40s and early 50s. Women get divorces and begin to make bad decisions."

"People less than 40 tend to get into more trouble."

"It is difficult to determine. Wide variety, but definitely men in their 50s."

"Men over 50 most often if they have gotten into a lot of problems are in prison by their 50s. However, I will see them if they are between troubles. Women tend to be more diverse with their ages."

9. In your professional capacity, particularly for your clients, what primarily is their sex or gender?

Responses:

“I tend to see more males.” Same response across all participants.

10. In your professional capacity, particularly for individuals with past drug or alcohol problems, with or without DUI or DWI offenses, would or did they comment about the age that they began drinking or using drugs? Did their parents use drugs or alcohol?

Responses:

“In Cajun culture people tend to start drinking at young ages. I would say 15-16 years of age. Parents do not realize that kids associate drinking with being mature and older, but they cannot manage this addiction, particularly at a young age. I would say 15 or 16. Parents definitely have a history of frequent drug use.”

“I really don’t get that information. I never ask. That is more appropriate for a counselor to ask.”

“People will often talk about their parents, or even blame their parents. Parents most often use alcohol or drugs themselves. It’s a generational thing. What age? I am heard people remark that they began using alcohol at 13-14 and drugs before 16.”

“A number that comes to mind is 16. Many individuals will begin drinking by age 16.”

11. For new Probation Officers or individuals that want to enter your field of work, particularly wanting to work with DWI and DUI offenders, what recommendations would you have for these aspiring officers?

Responses:

“It is a tough field. It is not very glamorous. Perhaps 5% will be appreciative of what you do. Most will believe you are a pain. Look at your mission and don’t take things personal.”

“Don’t get too personal with the clients. New folks do not realize when they are being manipulated. Be careful to not take situations too personal, especially when someone you think will be successful eventually gets back into trouble.”

“Know the law and know the rules. When you bend rules, both you and your person can get into trouble. Don’t get emotional.”

“Leave your work at work. Don’t let work come into your family life. The two concepts should not mesh.”

12. Based on your professional experience, are there policy, legislative, or procedural recommendations you would offer to policy makers or government officials, or even researchers, to help curtail, reduce, or eliminate the occurrence of drinking and driving?

Responses:

“There is a disconnect between the intent of the law, especially when individuals get more than 1 DWI, and then when they get more than 3.”

“More access to Lyft and Uber would be vital towards stopping drinking and driving. However, how can you stop people from drinking too much in the first place? We spend a lot of time and money on the results, drunk driving, but not a lot of time on stopping people from drinking in the first place.”

“Policy—more negative consequences for multiple offenses. Legislative—I really do not see legislators get involved-they talk, but no real world solutions. Researchers—more information needed on risky behaviors and why people really are willing to risk their health and essentially harm others by drinking and driving.”

13. Based on your professional experience, do you have any other suggestions for how to prevent drinking and driving?

Responses:

“Pay for services, like Uber, can help. However, these are expensive. Perhaps governmental programs can help pay for these expensive programs.”

“Stop people from drinking too much in the first place.”

“Have real consequences for second, third, and fourth offenses.”

“Economics and income make a big difference. However, not just poor folks get into trouble. But, you need not be careful about making assumptions about age. Legalization of marijuana will create a new string of problems.”

Pastors/Priests (n = 3)

1. In your church, approximately how many individuals that you provide counseling have incurred prior DWI or DUI offenses?

Responses:

“It happens occasionally. Difficult to say how often.”

“It will happen 5-6 times a year. No every month, but frequently.”

“I deal with more family matters. Alcohol or drugs will be discussed, but not really legal. Legal may be secondary to other conversations.

2. For individuals with DWI or DUI offenses, what are common concurrent past or current charges? For example:
    a. Robbery
    b. Assault
    c. Drug charges
    d. Other charges

Responses:

“I don’t get that information.”

“I deal more often with family issues. For more complex, I will refer to a professional counselor.”

“I do not really know.”

3. Is it common for these individuals to have other personal or counseling concerns, such as the following:

a. Intelligence or mental processing issues

b. Family complications, such as marriage difficulties

c. Difficulties with their children, such as parent-child relationship problems

Responses:

“Family and children issues will accompany drug and alcohol issues.”

“Not really intelligence or mental processing issues. My clients will generally have advanced education.”

“Parent-child relationships will always come into play, especially when they come for counseling.”

4. As a Pastor or Priest, do individuals that you provide counsel, particularly those with alcohol or drug problems, tend to participate in formal treatment, or most often attempt to address or deal with their addiction without formal treatment, such as AA or NA?

Responses:

“I will tend to get individuals that initially have family problems and then alcohol issues will become evident. If alcohol or drugs is primary issue, I will refer or tell the person about other professional services with more experience in alcohol and drug abuse. I will follow up. I would estimate that most probably 85% of individuals will seek professional services.”

“Often, I will receive or talk to individuals after they receive formal counseling, and then I will begin to address family issues.”

“Most will receive services beyond me, particularly if there is a combination of physical and emotional problems associated with addiction. I will primarily work with family issues. I am weary about alcohol or drugs with substantial physical addiction.”

5. In your professional opinion, what could improve the ability for you as a Priest or Pastor to successfully minister or counsel individuals with drinking and driving problems?

Responses:

“New individuals to the field need to recognize when folks can use spiritual guidance and then recognize when drug or alcohol counseling is beyond their skills, and someone with more medical or expertise is needed.”

“Recognize up front if you have the skills. Priests and pastors are have excellent communication and some have better and some have not-so-good counseling skills, but have great spiritual strength. “

“I need to maintain my counseling skills through my spirituality.”

6. In your professional capacity, particularly for individuals that you counsel with drug or alcohol problems, what primarily are their educational backgrounds?

Responses:

“No specific background. Varies widely.”

“No specific trends.

“There is some trends suggesting poorer individuals will have greater chances for drug or alcohol abuse. However, I am concerned that this may be simply a perception. Never really seen stats on this issue.”

7. In your professional capacity, particularly for individuals that you counsel with drug or alcohol problems, what primarily are their vocational or work backgrounds?

Responses:

“I tend to see trends with folks in the oilfield, but I tend to see the wives not the husbands. It is rare that I see the husbands.”

“Oilfield is a problem, particularly when the oilfield bottoms out. However, don’t be misperceived. Substance abuse goes across the career spectrum.”

“With the most recent problems with Covid, it is beginning to change. It was primarily oilfield in the past, but now it is very broad—expect across all careers now.”

8. In your professional capacity, particularly for individuals that you counsel with drug or alcohol problems, what primarily are their ages?

Responses:

“I work primarily with the wives, and their ages are in the 50s. For these, their husbands have had problems for the past 15-20 years.”

“I will get referrals from mothers to speak primarily with their sons. These are males in the late teens to early 20s. I am also often concerned about males that get laid off in their 50s or retire in their early 60s.”

“I tend to work with people in their 30s, 40s and 50s.”

9. In your professional capacity, particularly for your clients, what primarily is their sex or gender?

Responses:

“Males. Definitely.”

“Males, but be cautious that I also consult with females.”

“Males primarily.”

Everyone prefaced their responses with “For drug and alcohol problems.”

10. In your professional capacity, particularly for individuals that you counsel with drug or alcohol problems, would or did they comment about the age that they began drinking or using drugs? Did their parents use drugs or alcohol?

Responses:

“I really do not often think about this question.”

“There is a generation component to drinking and drugs. I definitely see a generation to generation feature.”

“I have been working in this capacity for a long time. I will see individuals, particularly boys, begin drinking in their early teens.”

“If parents use alcohol, their kids will use alcohol.”

11. For your clients, particularly for individuals that you counsel with drug or alcohol problems, or were they polysubstance abusers. Namely, did they also have a history of using drugs in addition to alcohol?

Responses:

“I think people primarily use alcohol, but I could be fooled.”

“Particularly for pre-divorce, there seems to be often a problem with multiple substances.”

“I do foresee multiple substances be a problem, particularly with the younger generation. I think most of the people that I see primarily use alcohol.”

12. If they have a history of using drugs, was their drug abuse based upon scripted medications or primarily illegal drugs / prescriptions?

Responses:

“Over the last 10 years, I have seen scripted drugs to be more problematic. I am not really exposed to folks with illegal drugs.”

“Parishioners are at present dealing with legalization of marijuana issues. I know people in the Church illegally use marijuana. However, there is a challenge between legalization versus pain relief versus lack of access to healthcare.”

“People will have kids that illegally use drugs. And, most probably, many in my church will illegally use drugs, but I don’t think this represents the majority of the people that I counsel or provide spiritual guidance.”

13. For new Pastors or Priests or individuals that want to enter your field of work, particularly wanting to work with DWI and DUI offenders, what recommendations would you have for these aspiring individuals?

Responses:

“Humbly, recognize that drug and alcohol use represents a major problem with several of your flock. You cannot ignore this real problem.”

“Counseling requires both spirituality and knowledge of applied counseling skills.”

“Understand your limits. Refer if you do not have the skills and cannot understand the physiology and psychological frailties for addiction.”

14. Based on your professional experience, are there policy, legislative, or procedural recommendations you would offer to policy makers or government officials, or even researchers, to help curtail, reduce, or eliminate the occurrence of drinking and driving?

Responses:

“Public education about drinking, driving. New efforts must focus on driving and marijuana use.”

“There must be increased access to transportation issues, such as Uber and Lyft. People will continue to drink, but they need more forms to get home.”

“Very simply if people drank less, they would not have the challenge of drinking and driving. Too much focus on getting home and not much focus on simply not drinking too much.”

15. Based on your professional experience, do you have any other suggestions for how to prevent drinking and driving?

Responses:

“People often do not thing about alcohol and drug use and spirituality as one in the same. Excessive use affects everyone. It represents a sin against self and God and the community. People will need medical doctors, particularly with DT’s and physiological aspects of drinking and drugs—people need to think about their spiritual development.”

“Drinking and drugs are most often thought about as a personal choice. These choices affect everyone. Selfishness must be addressed in the context of faith.”

“If you do not have a problem with drinking you will not have a problem with drinking and driving. A lot of focus is spending on the results of bad decisions. If you do not drink too much you can drive home safely. Focus less on stopping drinking and driving and focus more on responsible behavior before you start drinking too much.”

Counselors and Psychologists (n = 2)

1. What is your role in the treatment of people with alcoholism or drug addictions?

Response:

"I treat individuals that are generally referred by the court system, whether DOT or Family Court. Across both agencies, I will complete an assessment and make recommendations. My recommendations are generally the current severity of a circumstance and recommendations for some type of remediation or diversion."

"I work in a Family Practice. Often individuals will come to me based upon family pressure or insistence."

2. Do you treat or provide services for individuals that have incurred or been arrested for DWI or DUI offenses?

Response:

"Yes."

"Do it on a daily basis."

3. Specifically for individual with DWI or DUI offenses, what services may you expect to provide beyond strictly face-to-face counseling?

    a. Screening and assessment

    b. Legal assistance or guidance

    c. Case management

    d. Referral for medical detoxification

    e. Family oriented services, such as visitation, childcare, or re-unification

Responses:

"All of the above."

"A-D of the above. However, for E it is often a co-requirement, but not really my general purpose."

4. What are the main challenges that a person with a DWI or DUI face when they seek your assistance?

Response:

“Oftentimes, people will seek treatment because they are pressed to participate in treatment. Successful treatment does not work like that—you can lead a horse to water but you cannot make them drink.”

“Some individuals truly believe that a specific negative situation prompts them to make changes. However, counseling in isolation is not enough. People may mentally say ‘I want to change’ but rehabilitation requires physical and mental rehabilitation. At times people simply don’t have insurance. They need concurrent medical care, which may not be immediately available.”

5. Most often, when they seek your care, do they seek counseling or mental health treatment independently, or they are seeking treatment primarily because it is court-ordered?

Response:

“Very rare people will seek counseling before they get into trouble. The court system will prompt people, but people most often here because they have to.”

“They do not seek independent treatment. The court-system prompts them more often than even their family or significant others.”

6. How often do you provide services for individuals that need your services, but have not received a DUI or DWI?

Responses:

“All my referrals have a DUI or DWI.”

“I may be requested to help out with a family law circumstance and someone does not have a DUI or DWI. Most often, someone has a DUI or DWI.”

7. Are there any distinct differences in treatment protocols or receptiveness to treatment among people that receive your services with or with prior DWI and DUI offenses?

Responses:

“No not really.”

“Only thing I can think of, is that often people with DUI and DWI do not want treatment. They enjoy being drunks.”

8. How do you monitor the progress of treatment for individuals with DWI or DUI charges? Is it different for individuals without these charges?

Responses:

“Not really.”

“Protocol must be followed for everyone. At times the required reporting may be different. But treatment and types of counseling are somewhat traditional.”

9. In your professional capacity, particularly for individuals that you counsel with drug or alcohol problems, what primarily are their educational backgrounds?

Responses:

“It varies significantly. The idea that only the poor are alcoholics or addicted to drugs is incorrect.”

“No particularly pattern. It is obvious that persons with insurance can receive treatment and those without insurance have more difficult problems. Unfortunately, for those without insurance, inpatient treatment options are very limited.”

10. In your professional capacity, particularly for individuals that you counsel with drug or alcohol problems, what primarily are their vocational or work backgrounds?

Responses:

“I tend to get several individuals in the oilfield industry. And, there are those in the service-industry. And, trade fields. I know when people on the rigs get money, as they tend to get into trouble. Age and large amounts of money are difficult combinations.”

“At times the availability of legal help will definitely vary by economic resources. However, one should be careful about ‘poor economics and poor decision’ arguments.”

11. In your professional capacity, particularly for individuals that you counsel with drug or alcohol problems, what primarily are their ages?

Responses:

“Males in their early 20s, and males in their mid-50s.”

“I tend to receive folks across all ages. However, early 20s and mid-50s.”

12. In your professional capacity, particularly for your clients, what primarily is their sex or gender?

Responses:

“Male” across both

“Primarily male. However frequency of female referrals is increasing with time.”

13. In your professional capacity, particularly for individuals that you counsel with drug or alcohol problems, would or did they comment about the age that they began drinking or using drugs? Did their parents use drugs or alcohol?

Responses:

“Parental exposure a key to understanding history. Teenage years or even earlier.”

“Parents used alcohol. Teenage years most frequent age began. However, many individuals, particularly in their early 20s, will often get negatively exposed to alcohol in college, or with fraternities. And, for females, sororities and the college experience will offer negative influences.”

14. Do these individuals tend to use only alcohol, or are they polysubstance abusers?

Responses:

“I will most often get referrals when they are primarily using alcohol. However, if they do not have additional resolution, polysubstance may be problematic in the future.”

“Few people with legal problems will just use one form of substance. Some will be primarily addicted to uppers or downers or benzos. However, overall, multiple substances are most often.”

15. What percentage would you estimate, begin to use alcohol and drugs again within a year after leaving treatment?

Responses:

“Success rates at one year post treatment at 15% is good. So, 85% are unable to remain clean.”

“Even with severe negative consequences. 15-20% success rate would be considered a success.”

16. What percentage would you estimate have another DWI or DUI after leaving treatment?

Responses:

“I really do not get that information. However, there is a difference between not getting a DWI and having additional strategies for getting home. I do believe more people are thinking ahead when they are drinking. However, for some communities Uber is not available.”

“It is difficult to determine. Drinking and driving versus getting caught is two different things. A large percentage will drink and drive again; however, I am uncomfortable offering an estimation. I really do not have data for that information.”

17. What is the biggest difference among people that you serve regarding those that are successfully rehabilitation versus those that revert back to alcoholism or drug use?

Responses:

“People have to be ready. The court system cannot force people to be ready.”

“If families offer a ‘last chance scenario” people will often change for the better.”

18. For new graduates or individuals that want to enter your field of work, particularly wanting to work with DWI and DUI offenders, what recommendations would you have for these new graduates?

Responses:

“Recognize the field needs people with skills. Declaration of a degree simply in psychology or social work or counseling will not give you the skills to be a good advocate or counselor or to offer guidance. Continuously enhance your speaking skills. And, leave your prejudices at home.”

“Begin to understand the court system. Recognize that you have dual roles as consult and counselor. At times the roles may or may not coincide. Understand the procedural and ethical components of each role.”

19. Based on your professional experience, are there policy, legislative, or procedural recommendations you would offer to policy makers or government officials, or even researchers, to help curtail, reduce, or eliminate the occurrence of drinking and driving?

Responses:

“Education, way before even high school, needs to occur. DARE did not work. Something has to work but it has not been identified or at least implemented. There needs to begin research pertaining to legalized marijuana and driving—that research will occur too late.”

“More money and resources and information is needed for treatment. Treatment must veer against simply prepping people for prosecution. More people in jail will not resolve the problem. Check points should continue. Alternative treatment options such as Uber must continue to be available.”

20. Based on your professional experience, do you have any other suggestions for how to prevent drinking and driving?

Responses:

“There needs to be more Uber-based options. Admittedly, people will drink and then these same people will need to get home. People will not stop drinking but we need to figure out how to get them to drive home safely.”

“This goes towards civil liberties—have people blow before they drive. If all cars were retrofitted this would not be a problem. However, would the impact of civil liberties be better? Difficult to determine.”

Defense Attorneys (n = 4)

1. In your practice, approximately how many clients have incurred prior DWI or DUI offenses? Do you know if any of the individuals that you monitor that concurrently have a DWI or DUI offense involved/strictly drugged-only driving offense?

Responses:

“Prefer not to answer”

“Enough cases to pay my bills.”

“Drugged driving cases are becoming more frequent. Difficult to defend. Science not available to refute.”

“Everyone has a drugged driving case that they are trying to figure out how to defend.”

2. For individuals with DWI or DUI offenses, what are common concurrent past or current charges? For example:
    a. Robbery
    b. Assault
    c. Drug charges
    d. Other charges

Responses:

“Prefer not to answer.” Same response across all participants.

3. As a Defense Attorney, do these individuals tend to participate in formal treatment, or most often attempt to address or deal with their addiction without formal treatment, such as AA or NA?

Responses:

“Prefer not to answer.” Same response across all participants.

4. In your professional opinion, what could improve the ability of a Defense Attorney to successfully defend individuals drinking and driving?

Responses:

“Better sharing of information.”

“Defendants to not get into trouble.”

“Defendants recognizing that the past will come up in court.”

“Greater ability to negotiate with District Attorneys.”

5. In your professional capacity, how often do the individuals that you defend for DUI or DWI offenses have secondary charges?

Responses:

“Prefer not to answer.” Similar across all participants.

6. In your professional capacity, particularly for your clients, what primarily are their educational backgrounds?

Responses:

“DUI folks tend to have lower education, but educated folks also get DUIs.”

“Biggest mistake—assuming DUIs are limited to just under educated.”

“Drinking and drug problems common across all educational backgrounds.”

“If you have money, you can afford Uber or similar transportation.”

7. In your professional capacity, particularly for your clients, what primarily are their vocational or work backgrounds?

Responses:

“Varies. No consistent career.” Same response across all participants.

8. In your professional capacity, particularly for your clients, what primarily are their ages?

Responses:

“Males from 18 to 35.”

“College ages.”

“Two ages, 18-25, and then males older than 50.”

9. In your professional capacity, particularly for your clients, what primarily is their sex or gender?

Responses:

“Tend to be males.”

“Mostly males, but also females.”

“Primarily males, but also several females.”

10. In your professional capacity, particularly for you clients, would or did they comment about the age that they began drinking or using drugs? Did their parents use drugs or alcohol?

Responses:

“I do tend to get families with a history. Like father, like son.”

“I tend to avoid serving the role of a counselor. I want to limit conversations to defending a case.”

“Defendants will often talk about their parent’s cases. So, I assume same problem with themselves.”

--No one would mention or estimate a time that alcohol or drug use began. Essentially this information is not obtained from attorneys.

11. For your clients, specifically a majority of your clients, did they primarily use alcohol, or were they polysubstance abusers. Namely, did they also have a history of using drugs in addition to alcohol?

Responses:

“I do not want to answer that question.” Same response across all participants.

12. If they had a history of using drugs, was their drug abuse based upon scripted medications or primarily illegal drugs / prescriptions?

Responses:

“I do not want to answer that question.” Same response across all participants.

13. For new Defense Attorneys or individuals that want to enter your field of work, particularly wanting to work with DWI and DUI offenders, what recommendations would you have for these aspiring officers?

Responses: “I do not have any comments for this question.”

14. Based on your professional experience, are there policy, legislative, or procedural recommendations you would offer to policy makers or government officials, or even researchers, to help curtail, reduce, or eliminate the occurrence of drinking and driving?

Responses:

“None that I can think of.”

“Researchers need to focus on critical decision making. The link between decision making and behavior needs to be understood better.”

15. Based on your professional experience, do you have any other suggestions for how to prevent drinking and driving?

Responses:

“Public education always remains a vital key.”

“Economics is always a factor. People feel down, they drink, and they make bad decisions.”

“Alternative drive-home options are always needed.”

“It will get worse with Covid. Mental health interventions are also needed.”

District Attorneys (n=3)

1. In your scope of work, approximately how many defendants with DWI or DUI offenses do you prosecute a month? Do you know if any of the individuals that you prosecute have a DWI or DUI offense involved/strictly drugged-only driving offense?

Responses:

Regarding number of prosecutions--“Prefer not to answer.” Same response across all participants.

“Drugged driving cases in increasing. However, difficult to at times prosecute.”

“Science is improving on prosecution of drug cases.”

“Drugged cases are more prevalent than 10 years ago.”

“Don’t know what will happen when marijuana becomes legal.”

2. For individuals with DWI or DUI offenses, what are common concurrent past or current charges? For example:
    a. Robbery
    b. Assault
    c. Drug charges
    d. Other charges

Responses:

“All of the above.” Same responses across all participants.

“Most often, DUI is a first or primary offense. Essentially people making bad decisions.”

3. As a District Attorney or Prosecutor, do these individuals tend to participate in formal treatment, or most often attempt to address or deal with their addiction without formal treatment, such as AA or NA?

Responses:

“Some will view this as a chance to turn their life around, and others do not. That is why they have multiple offenses.”

“Family pressure and opinions make a huge difference.”

“Often individuals will rationalize their drinking and driving. If they cannot accept responsibility their behaviors will continue.”

4. In your professional opinion, what could improve the ability of a District Attorney or Prosecutor to successfully prosecute individuals drinking and driving?

Responses:

“Community education remains vital, including notices of checkpoints.”

“Defense attorneys are continuing to develop loopholes.”

“Large number of cases. Workload always difficulty.”

5. In your professional capacity, how often do the individuals that you prosecute for DUI or DWI offenses have secondary charges?

Responses:

“Difficult to define ‘secondary charges’”

“Oftentimes, DUI results in property damage. But most often focus on DUI charge.”

“Keep in mind, to prosecute second charge, cop has to see the offense. Most often swerve or that type of observation. Judges prefer simply charges as opposed to stacking charges.”

6. In your professional capacity, particularly for individuals that you prosecute, what primarily are their educational backgrounds?

Responses:

“Varies. Difficult to determine. It is wrong to assume that people getting DUI are lower class folks.”

“DUIs cross all educational backgrounds.”

“Some times of month may result in higher or lower class, but difficult to determine. Tend to get older vehicles when monthly checks come in.”

“Recognize that cops tend to see the defendants more than. I really don’t know how to answer the question.”

7. In your professional capacity, particularly for individuals that you prosecute, what primarily are their vocational or work backgrounds?

Responses:

“Don’t know how to respond.”

“Wide variety. No particular trends.”

8. In your professional capacity, particularly for your clients, what primarily is their sex or gender?

Responses:

“Definitely males. Across the ages.”

“Males are more frequent.”

“Starting to see more females, but males more frequent.”

9. In your professional capacity, particularly for individuals that you prosecute, would or did they comment about the age that they began drinking or using drugs? Did their parents use drugs or alcohol?

Responses:

“I really do not get that information.”

“My role is to prosecute; I really do not get that information.”

10. For the defendants, based on your knowledge, did they primarily use alcohol, or were they polysubstance abusers. Namely, did they also have a history of using drugs in addition to alcohol?

Responses:

“At times, substance abuse history will be presented in the scope of prosecution, particularly if multiple prior DUIs. However, this is based on charges, not really scope of alcohol or drug abuse.”

“You tend to get folks ‘only alcohol’ or ‘polysubstance’; it varies significantly.”

“At times you get individuals that are ‘messed up.’ These folks use a bit of everything. This is information that I really do not get into.”

11. If they had a history of using drugs, was their drug abuse based upon scripted medications or primarily illegal drugs / prescriptions?

Responses:

“I really do not get that information.” Same responses were received across all participants.

12. For new District Attorney or Prosecutors or individuals that want to enter your field of work, particularly wanting to work with DWI and DUI offenders, what recommendations would you have for these aspiring officers?

Responses:

“Think about people as individuals, not simply as another case.”

“Be prepared for every day to be a new day.”

“Keep up with your paperwork. Return phone calls promptly. Get to know the Defense Attorneys, as well as your staff. Never lose sense of the importance of clerical staff.”

13. Based on your professional experience, are there policy, legislative, or procedural recommendations you would offer to policy makers or government officials, or even researchers, to help curtail, reduce, or eliminate the occurrence of drinking and driving?

Responses:

“Public education continues to be important. Not just drinking and driving, but also smart drinking.”

“Policy—create less loopholes. Government—offer greater tools to prosecute. Researchers—learn about the connections related to acceptance of risks, what-why do people willingly DUI.”

“Offer greater opportunities for trip or driving chances when people start drinking.”

14. Based on your professional experience, do you have any other suggestions for how to prevent drinking and driving?

Responses:

“Learn about why people are willing to accept the applicable risks.”

“Identify second means to get home if you have been drinking.”

“Keep promoting Uber and other means to get home.”

Appendix E

This section provides detailed graphs and tables containing a variety of descriptive statistics.

Figure 14. Distribution of crashes by collision type

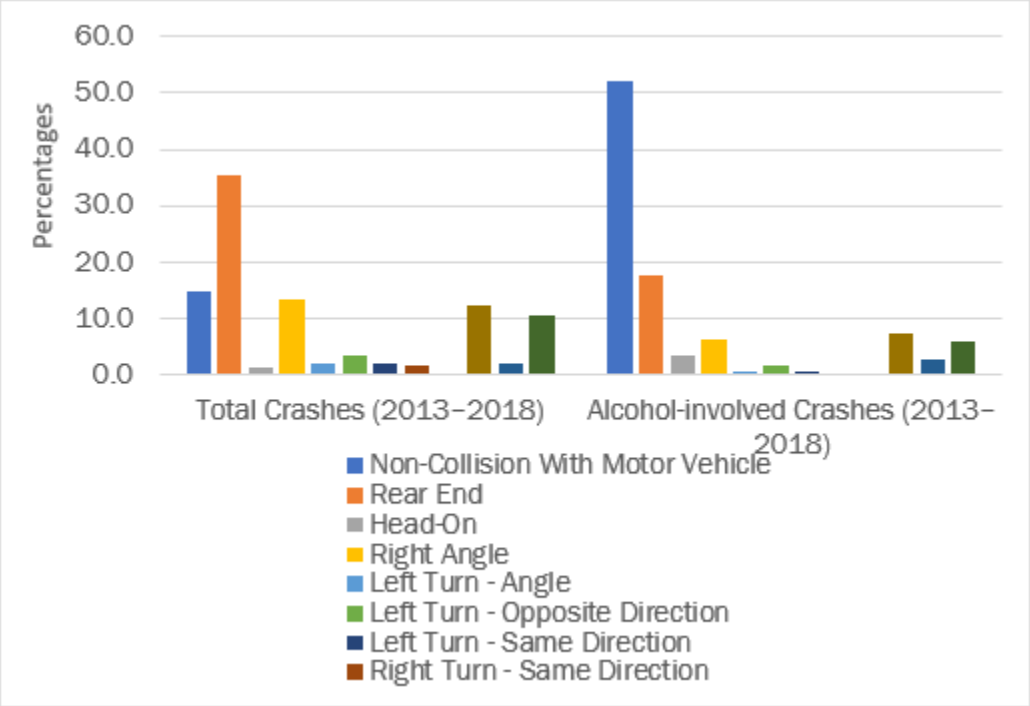


Figure 15. Distribution of crashes by locality type

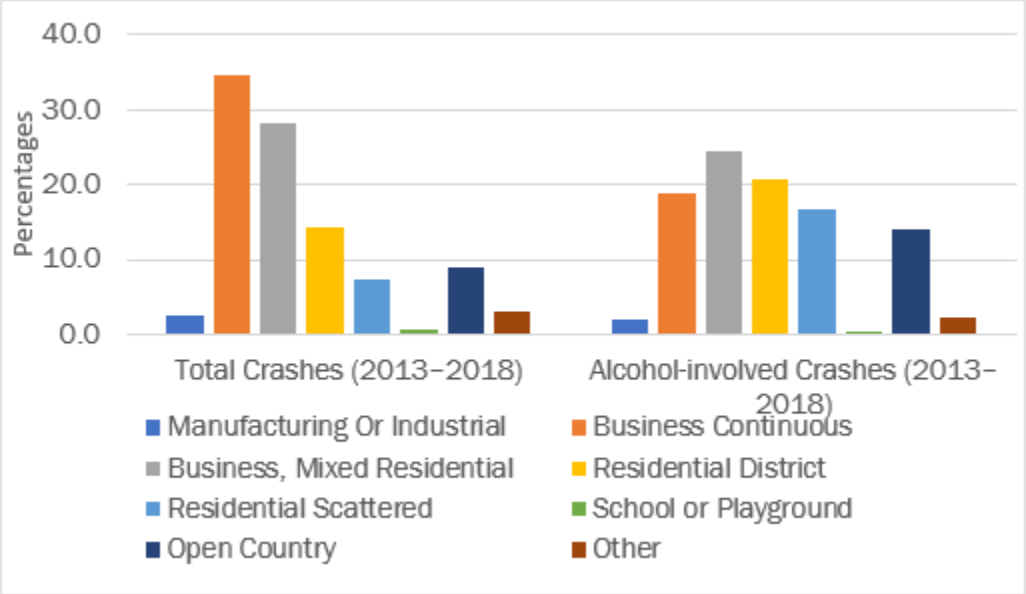


Figure 16. Distribution of crashes by highway type

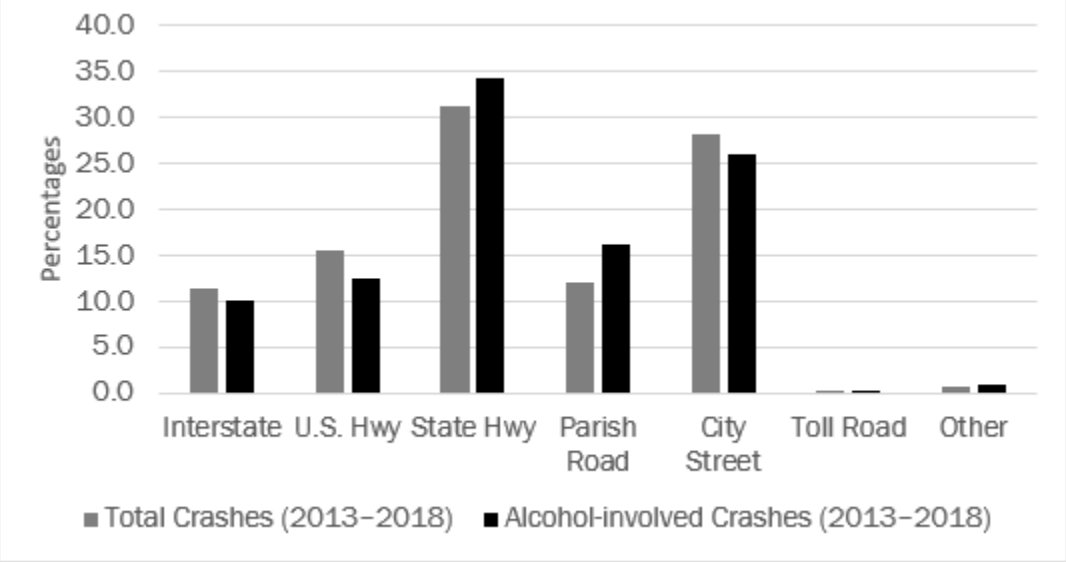


Figure 17. Distribution of crashes by roadway type

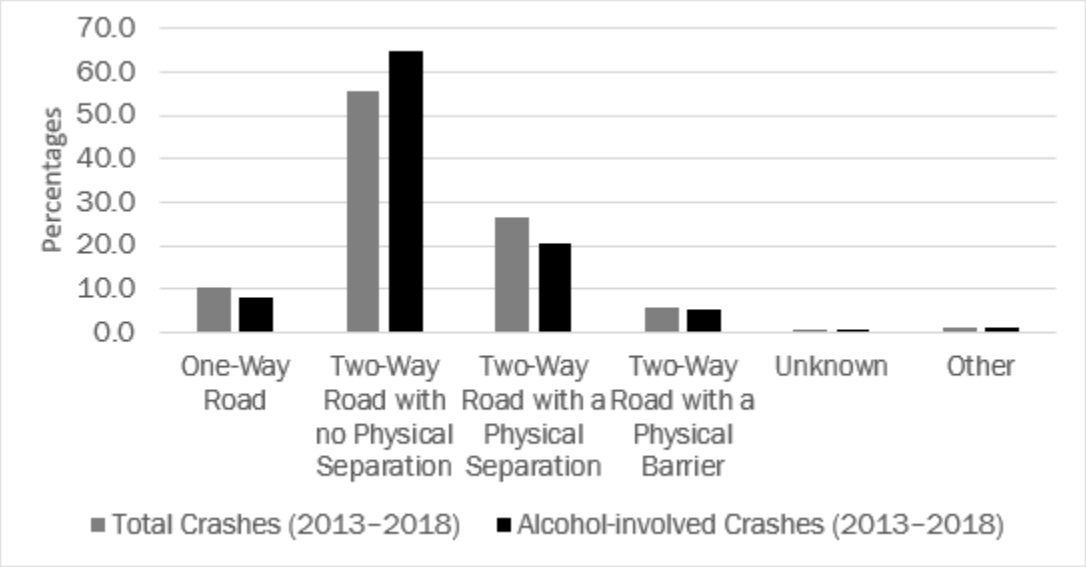


Figure 18. Distribution of crashes by driver gender

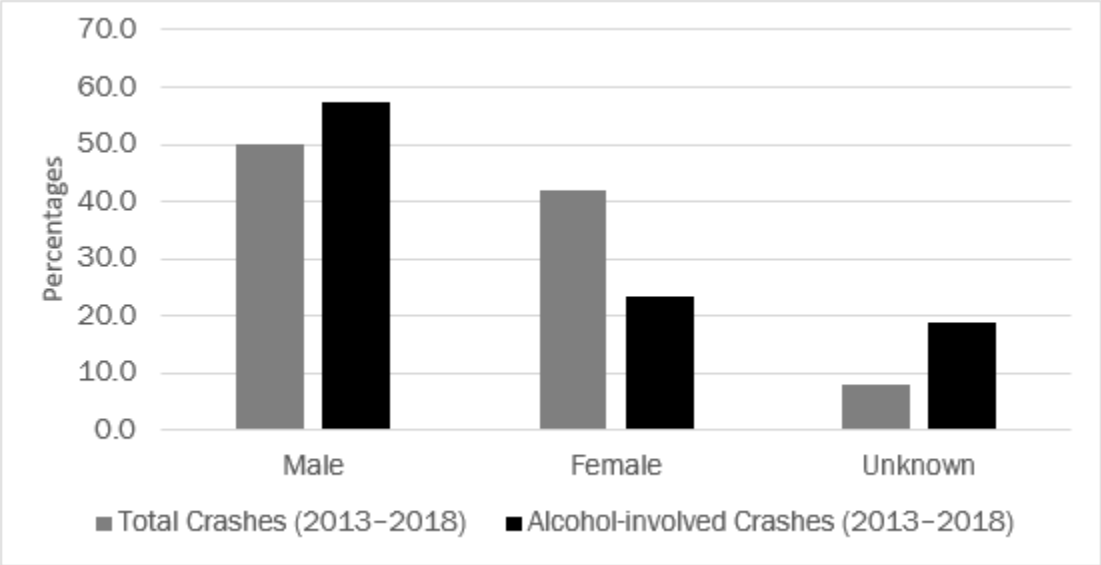


Figure 19. Distribution of crashes by driver age

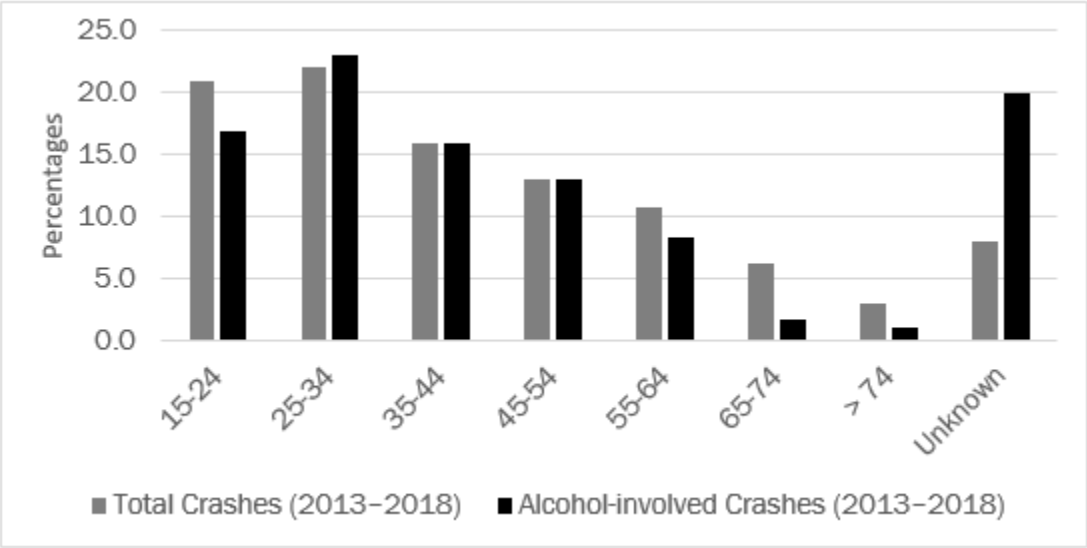


Figure 20. Distribution of selected crash types

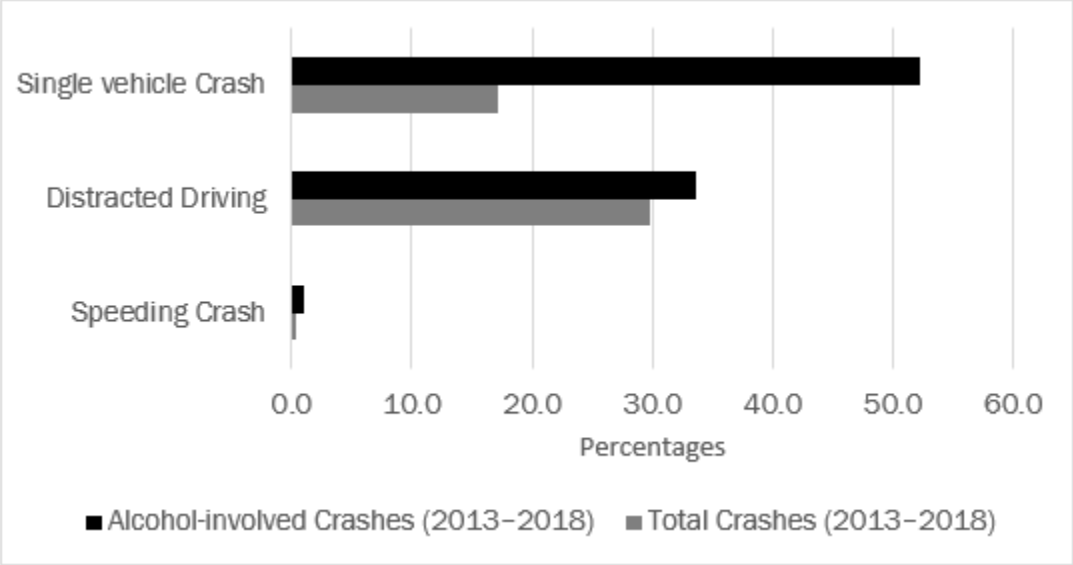
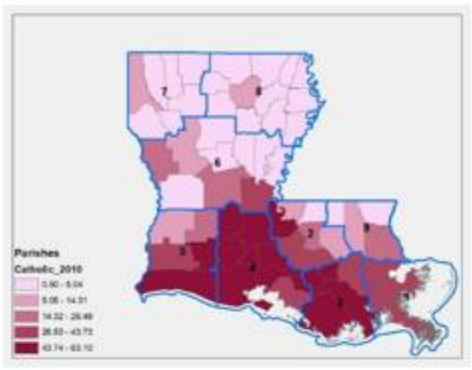
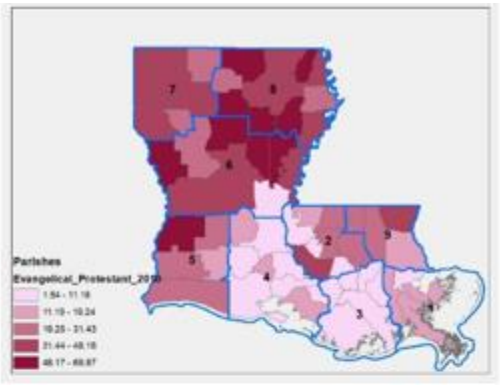


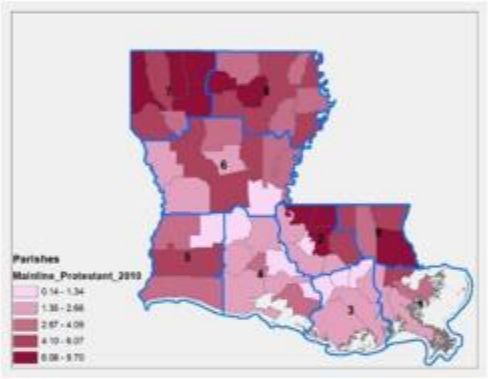
Figure 21. Religion, alcohol use, and median annual household income by parish [76, 77]



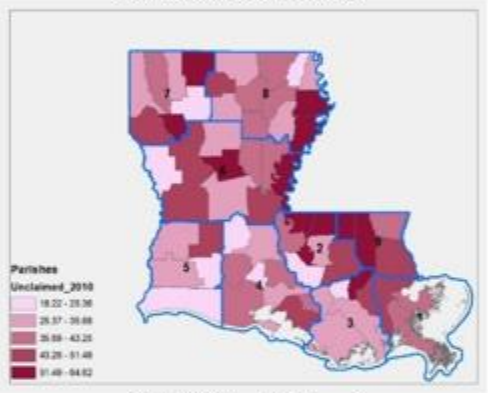
Catholic



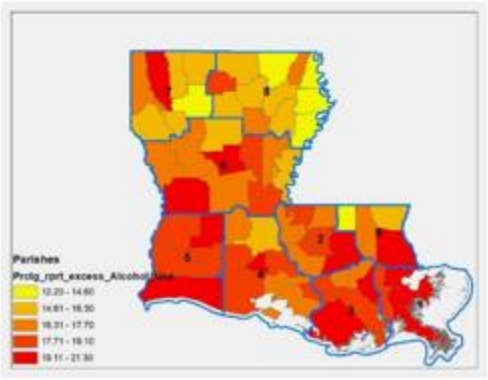
Evangelical Protestant



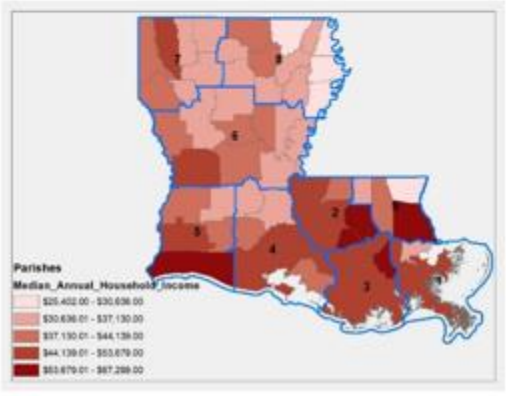
Mainline Protestant



No Religion Claimed



Percentage of Excessive Alcohol Use



Median Annual Household Income

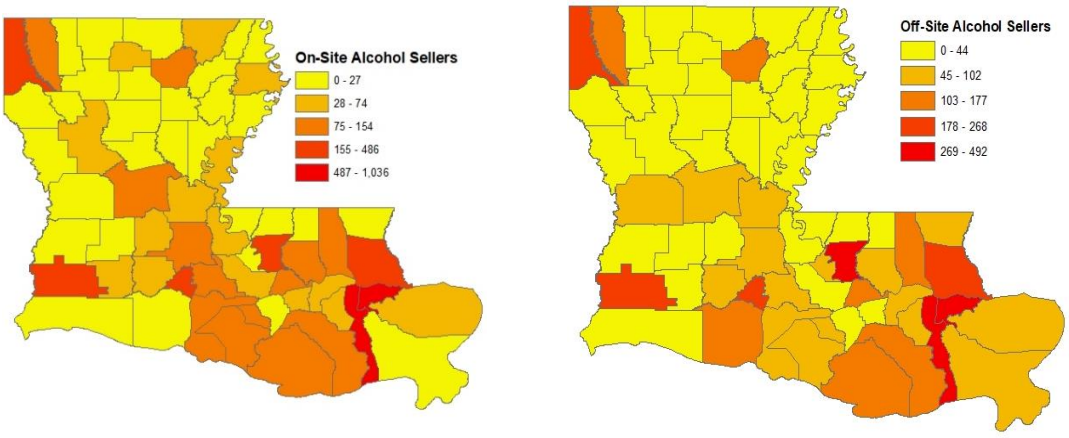
Table 25. Parish-level information

Parish	Total Crashes (2013–2018)			Alcohol-Involved Crashes (2013–2018)			Population Estimate (2016)	Arrests (Avg. 2016–2018)	Alcohol Sellers	
	KABCO	KA	K	KABCO	KA	K			On Site	Off Site
Acadia	8,840	172	78	616	83	40	61,773	42	74	86
Allen	2,299	77	30	235	40	17	25,764	16	21	22
Ascension	28,352	282	132	1,320	150	82	107,215	228	123	109
Assumption	2,612	46	31	255	21	15	23,421	16	27	28
Avoyelles	5,117	70	40	481	34	24	42,073	91	50	58
Beauregard	4,118	73	33	244	42	24	35,654	54	6	22
Bienville	1,884	35	18	157	19	10	14,353	21	16	13
Bossier	24,198	266	66	942	124	43	116,979	267	137	115
Caddo	61,618	867	204	2,643	418	135	254,969	421	272	227
Calcasieu	49,650	498	190	2,695	284	124	192,768	150	235	267
Caldwell	378	24	15	33	10	6	10,132	9	9	12
Cameron	909	20	6	102	11	4	6,839	10	2	18
Catahoula	537	14	9	83	9	8	10,407	11	14	9
Claiborne	1,329	29	11	94	14	4	17,195	13	8	14
Concordia	1,680	37	22	136	20	11	20,822	9	30	26
De Soto	3,473	56	28	260	37	19	26,656	41	23	13
East Baton Rouge	136,137	1,039	306	4,695	547	194	440,171	893	486	492
East Carroll	479	18	7	23	9	4	7,759	8	8	11
East Feliciana	416	54	41	74	35	27	20,267	17	7	15
Evangeline	4,649	64	35	398	40	22	33,984	44	35	37
Franklin	1,383	43	26	103	27	17	20,767	23	10	17
Grant	1,061	34	28	143	22	20	22,309	22	5	8
Iberia	12,613	146	77	790	81	49	73,240	46	110	66
Iberville	5,993	146	60	335	71	32	33,387	28	62	26
Jackson	743	33	18	54	19	11	16,274	25	21	4
Jefferson	101,211	453	154	3,918	239	91	432,552	683	722	435
Jefferson Davis	5,101	81	48	415	42	28	31,594	7	40	34
Lafayette	69,226	533	154	3,099	262	90	221,578	321	364	255
Lafourche	14,740	156	119	1,003	85	63	96,318	230	103	149
La Salle	1,230	29	18	119	15	10	14,890	23	14	10
Lincoln	8,070	87	33	344	37	16	46,735	71	39	39
Livingston	24,820	358	138	1,341	205	89	128,026	177	121	97
Madison	1,572	53	29	132	26	18	12,093	18	34	10
Morehouse	3,262	64	30	173	38	19	27,979	43	41	15
Natchitoches	7,505	88	43	445	50	24	39,566	95	67	23
Orleans	120,241	1,625	279	5,514	766	173	343,829	471	1,036	481

Parish	Total Crashes (2013–2018)			Alcohol-Involved Crashes (2013–2018)			Population Estimate (2016)	Arrests (Avg. 2016–2018)	Alcohol Sellers	
	KABCO	KA	K	KABCO	KA	K			On Site	Off Site
Ouachita	34,597	345	130	1,317	173	89	69,518	230	148	164
Plaquemines	2,665	56	14	145	35	10	23,042	35	22	53
Pointe Coupee	2,076	86	45	179	47	30	22,802	8	48	34
Rapides	29,787	229	106	1,388	110	55	131,613	303	121	92
Red River	1,237	29	20	97	17	11	9,091	25	10	10
Richland	2,515	51	26	147	19	11	20,725	31	16	16
Sabine	1,704	60	39	180	33	23	24,233	27	27	18
St. Bernard	6,733	73	28	306	49	19	35,897	34	64	70
St. Charles	9,548	111	47	568	58	29	52,780	123	47	56
St. Helena	1,068	34	30	130	21	19	11,203	24	8	22
St. James	4,522	50	29	279	25	18	22,102	6	32	32
St. John the Baptist	8,845	124	55	465	74	33	45,924	113	54	53
St. Landry	14,493	191	120	1,088	119	87	83,384	67	138	102
St. Martin	10,314	144	73	709	83	44	52,160	59	114	85
St. Mary	7,102	121	58	504	65	33	54,650	26	96	66
St. Tammany	41,332	366	141	1,810	191	85	233,740	499	266	268
Tangipahoa	26,442	385	176	1,341	211	113	121,097	249	146	138
Tensas	300	15	8	54	8	6	5,252	8	6	11
Terrebonne	21,807	172	104	1,220	105	75	111,860	291	154	177
Union	2,485	54	31	195	29	16	22,721	11	1	33
Vermilion	8,070	116	45	697	67	28	57,999	30	0	126
Vernon	4,591	89	53	356	51	35	52,334	138	0	58
Washington	5,084	132	60	316	68	38	47,168	63	0	73
Webster	5,454	137	47	311	70	28	41,207	76	1	44
West Baton Rouge	9,182	129	55	379	74	36	23,788	27	0	90
West Carroll	770	18	9	66	12	5	11,604	18	0	0
West Feliciana	1,023	44	15	53	26	8	15,625	24	0	33
Winn	905	30	20	67	22	15	15,313	14	0	15

Note: Avg. = average. Population is 2016 based on U.S. Census projections, Arrests refers to the number of arrests that are alcohol related with a BAC of 0.08 or higher in 2018. On-site sellers are where people can purchase alcohol and drink it on site versus off site where sellers do not allow consumption on their premises.

Figure 22. Frequency of alcohol sellers by parish



On-site alcohol sellers

Off-site alcohol sellers

Table 26. Correlations between fatal alcohol-involved crash counts and proportion of total fatal crashes and cultural factors at the parish level

Variable	Fatal Alcohol-Involved Crash Count	p-value	Fatal Alcohol-Involved Crash Proportion	p-value
Alcohol Crash Count	1.000	N/A	0.276	0.027
Number Housing Units	0.868	<0.001	0.105	0.408
Population (2016)	0.869	<0.001	0.106	0.405
Percentage African American	0.048	0.708	0.012	0.926
Percentage Hispanic	0.311	0.013	0.157	0.217
Percentage Non-Hispanic White	-0.138	0.278	-0.070	0.582
Percentage Asian	0.530	<0.001	0.309	0.013
Percentage American, Indian, Alaskan and Native	0.015	0.905	0.100	0.432
Percentage of Native, Hawaiian, Other and Pacific	0.155	0.222	0.295	0.018
Percentage Reporting Excess Alc. Use	0.362	0.003	0.176	0.165
Median Household Income	0.259	0.039	0.049	0.700
Percentage Female	0.357	0.004	-0.028	0.823
Percentage Age < 18 Years	0.078	0.542	0.267	0.033
Percentage Age 18–24 Years	0.295	0.018	0.065	0.610
Percentage Age 25–44 Years	0.238	0.058	0.137	0.279
Percentage Age 45–64 Years	-0.265	0.034	-0.207	0.102
Percentage Age 65+ Years	-0.404	<0.001	-0.263	0.035
Median Age (years)	-0.415	<0.001	-0.265	0.034
Ratio of Males Age 18+ per 100 Female	-0.324	0.009	-0.076	0.550
Annual Vehicle Miles Traveled	0.894	<0.001	0.096	0.449
Mileage (2017)	0.242	0.054	-0.018	0.885
Percentage Evangelical Protestant	-0.323	0.009	-0.188	0.137
Percentage Black Protestant	0.047	0.713	-0.132	0.299
Percentage Mainline Protestant	0.099	0.437	-0.303	0.015
Percentage Orthodox	0.724	<0.001	0.118	0.355
Percentage Catholic	0.275	0.028	0.202	0.109
Percentage Other Religions	0.491	<0.001	0.134	0.291
Percentage Unclaimed Religions	-0.089	0.483	0.018	0.888
Number of Intoxication Arrests (2015)	0.746	<0.001	0.040	0.753
Number of Intoxication Arrests (2016)	0.788	<0.001	0.078	0.538
Number of Intoxication Arrests (2017)	0.793	<0.001	0.100	0.431
Number of Intoxication Arrests (2018)	0.810	<0.001	0.091	0.475
Number of Alcohol Outlets (on sale) per Capita	0.706	<0.001	0.091	0.474
Number of Alcohol Outlets (off sale) per Capita	-0.013	0.921	0.104	0.415

Variable	Fatal Alcohol-Involved Crash Count	p-value	Fatal Alcohol-Involved Crash Proportion	p-value
Rate of Chronic Liver Disease per 100,000 pop. (2013–2016)	0.023	0.859	0.000	0.997
Rate of Arrests Due to Driving while Intoxicated per 100,000 pop. (confirmed test >=0.08 BAC) (year)	−0.015	0.906	−0.061	0.631
Percentage Youth—Drink Alcohol in a Car (2010)	−0.356	0.004	0.101	0.428
Percentage Youth—Drink Alcohol in a Bar (2010)	0.113	0.375	0.168	0.186
Percentage Youth—Adult Public Drunkenness Not Wrong (2016)	0.117	0.359	0.094	0.459
Percentage Youth—Adult Drinking in Public Not Wrong (2016)	0.416	<0.001	0.144	0.256
Percentage Youth—Alcohol Use (past 30 days; 2016)	0.061	0.631	0.063	0.621
Percentage Youth—Easy to Buy Alcohol from Store (2016)	−0.154	0.225	−0.033	0.797
Percentage Youth When Used Alcohol (past year)—Usually Got It from Their Home with Parent Permission	0.086	0.498	0.176	0.163
Percentage Youth When Used Alcohol (past year)—Usually Got It from Their Home without Parent Permission	0.167	0.188	−0.027	0.832
Percentage Youth—Driving after Drinking (2016)	−0.198	0.117	−0.033	0.797
Percentage Youth—Not True or Definitely Not True That Someone Drinking and Driving in Neighborhood Would Be Caught by Police (2016)	−0.220	0.081	0.009	0.945
Percentage Youth—Riding with a Driver Who Had Drank Alcohol (past 30 days)	−0.205	0.103	0.000	0.998
Percentage Youth—Comm. Laws Norms Fav. to Drug Use	−0.079	0.537	0.135	0.287
Percentage Youth—Marijuana Past 30 Days (2016)	0.422	<0.001	0.259	0.039
Percentage Youth—Attitude toward Drug Use	0.290	0.020	0.013	0.918
Percentage Youth—Parents toward Drug Use	0.093	0.464	0.125	0.327
Percentage Youth—Meth Past 30 Days (2016)	0.069	0.590	−0.021	0.872
Percentage Youth—Rx Narcotics Past 30 Days (2016)	0.119	0.350	0.064	0.617
Percentage Youth—Synthetic Marijuana Past 30 Days (2016)	0.060	0.637	0.029	0.822
Percentage Youth—Cigarettes Past 30 Days (2016)	−0.081	0.524	−0.093	0.463

Variable	Fatal Alcohol-Involved Crash Count	p-value	Fatal Alcohol-Involved Crash Proportion	p-value
Percentage Youth—E-cigarettes Past 30 days (2016)	0.231	0.066	0.035	0.783
Percentage College—Arrested for DUI/DWI Past Year (2017)	0.053	0.678	−0.069	0.588
Percentage College—Driven under Influence Past Year (2017)	0.151	0.233	−0.035	0.781
Percentage College—Used Alcohol Past 30 Days (2017)	0.003	0.983	−0.105	0.409
Percentage College—Used Marijuana Past 30 Days (2017)	−0.059	0.643	−0.029	0.820
Percentage College—Used Cigarettes Past 30 Days (2017)	−0.067	0.599	0.155	0.220
Percentage College—Used Opiates Past 30 Days (2017)	−0.125	0.325	0.131	0.303
Percentage of Owner-Occupants	−0.249	0.047	−0.113	0.374
Rate of Population with a Bachelor's Degree or Higher (2016)	0.342	0.006	0.071	0.577

Note: N/A = not applicable.

Table 27. Percentages of key variables (all crashes vs. alcohol-involved crashes)

Variable	Attribute	All Crashes (2013–2018)	Alcohol-Involved Crashes (2013–2018)
Day of the Week	SA	12.6	24.7
Day of the Week	SU	10.1	23.4
Day of the Week	MO	14.6	8.8
Day of the Week	TU	15.0	8.6
Day of the Week	WE	14.9	8.7
Day of the Week	TH	15.4	9.7
Day of the Week	FR	17.4	16.2
Crash Hour	1	1.6	10.5
Crash Hour	2	1.2	9.2
Crash Hour	3	1.2	10.1
Crash Hour	4	1.0	6.5
Crash Hour	5	1.0	4.7
Crash Hour	6	1.6	1.7
Crash Hour	7	2.9	1.2
Crash Hour	8	5.5	0.9
Crash Hour	9	4.6	0.7
Crash Hour	10	4.0	0.7
Crash Hour	11	4.5	0.7
Crash Hour	12	5.5	0.9
Crash Hour	13	6.6	1.1
Crash Hour	14	6.2	1.2
Crash Hour	15	6.8	1.4
Crash Hour	16	8.3	2.0
Crash Hour	17	8.2	2.6
Crash Hour	18	8.8	4.5
Crash Hour	19	6.0	4.8
Crash Hour	20	4.1	5.3
Crash Hour	21	3.4	6.9
Crash Hour	22	2.9	7.4
Crash Hour	23	2.3	7.4
Crash Hour	24	1.8	7.5
Number of Involved Vehicles	Single	17.0	52.1
Number of Involved Vehicles	Multiple	83.0	47.9
Locality Type	Manufacturing or Industrial	2.5	2.1
Locality Type	Business Continuous	34.6	18.8
Locality Type	Business, Mixed Residential	28.2	24.6
Locality Type	Residential District	14.3	20.8
Locality Type	Residential Scattered	7.5	16.7

Variable	Attribute	All Crashes (2013–2018)	Alcohol-Involved Crashes (2013–2018)
Locality Type	School or Playground	0.7	0.4
Locality Type	Open Country	9.1	14.2
Locality Type	Other	3.1	2.4
Collision Type	Non-collision with Motor Vehicle	14.9	52.1
Collision Type	Rear End	35.4	17.8
Collision Type	Head-On	1.5	3.5
Collision Type	Right Angle	13.4	6.2
Collision Type	Left Turn—Angle	2.0	0.7
Collision Type	Left Turn—Opposite Direction	3.7	1.8
Collision Type	Left Turn—Same Direction	2.1	0.7
Collision Type	Right Turn—Same Direction	1.6	0.5
Collision Type	Right Turn—Opposite Direction	0.5	0.5
Collision Type	Sideswipe—Same Direction	12.3	7.3
Collision Type	Sideswipe—Opposite Direction	2.0	2.7
Collision Type	Other	10.5	6.0
Highway Type	Interstate	11.4	10.0
Highway Type	U.S. Hwy	15.6	12.4
Highway Type	State Hwy	31.3	34.3
Highway Type	Parish Road	12.0	16.3
Highway Type	City Street	28.2	26.0
Highway Type	Other	0.9	1.0
Crash Severity	Fatal	0.4	3.5
Crash Severity	Incapacitating	0.7	3.0
Crash Severity	Non-incapacitating	5.7	12.4
Crash Severity	Minor Injury	22.1	24.9
Crash Severity	No Injury	71.1	56.2
Road Type	One-Way Road	10.5	8.2
Road Type	Two-Way Road with No Physical Separation	55.7	64.9
Road Type	Two-Way Road with a Physical Separation	26.6	20.5
Road Type	Two-Way Road with a Physical Barrier	5.9	5.3
Road Type	Unknown	0.2	0.1
Road Type	Other	1.1	1.0
Driver Age	15–24	20.9	16.9
Driver Age	25–34	22.1	23.1

Variable	Attribute	All Crashes (2013–2018)	Alcohol-Involved Crashes (2013–2018)
Driver Age	35–44	16.0	16.0
Driver Age	45–54	13.0	13.0
Driver Age	55–64	10.8	8.3
Driver Age	65–74	6.2	1.7
Driver Age	>74	3.0	1.0
Driver Age	Unknown	8.0	20.0
Driver Gender	Male	49.9	57.5
Driver Gender	Female	42.1	23.5
Driver Gender	Unknown	8.0	19.0

Appendix F

This section provides information on the correlation analysis conducted across variables at the block group level. In addition, six correlation plots are provided depicting the relationship of the variables to one another stratified by different permutations of higher and lower crash severity by alcohol involvement or non-involvement.

Table 28. Variables included in the correlation analysis at the block group level

Variable	Description	Source
Used in Systemic Analysis		
Arrests	Number of Arrests (2016–2018)	Picard
Pop	Total Population Estimate	ACS
HH	Households—Total Population Estimate	ACS
M25_34	Males Age 25–34 Years—Total Population Estimate	ACS
RAC	Residence Area Characteristic (number of jobs) by Home Block Group	LEHD
WAC	Work Area Characteristic (number of jobs) by Work Block Group	LEHD
OD_Avg	Origin-Destination Data (average number of jobs) by Block Group	LEHD
OnS_Sell	On-Site Alcohol Sellers (2018)	Louisiana Alcohol and Beverage Commission
OffS_Sell	Off-Site Alcohol Sellers (2018)	Louisiana Alcohol and Beverage Commission
Intrsec	Number of Intersections	LADOTD
Alc_Cr	Alcohol-Involved Crashes (2013–2018)	LADOTD
Alc_K	Alcohol-Involved K Crashes (2013–2018)	LADOTD
Alc_KA	Alcohol-Involved KA Crashes (2013–2018)	LADOTD
All_Cr	All Crashes (2013–2018)	LADOTD
All_K	All K Crashes (2013–2018)	LADOTD
All_KA	All KA Crashes (2013–2018)	LADOTD
Not Used in Systemic Analysis		
PopM	Total Population Estimate—Male	ACS
PopF	Total Population Estimate—Female	ACS
F25_34	Females Age 25–34 years—Total Population Estimate	ACS
MP25_34	Percentage of Males (25–34 years)—Total Population Estimate	ACS
FP25_34	Percentage of Females (25–34 years)—Total Population Estimate	ACS
HHFam	Family Households—Total Population Estimate	ACS
HHNFam	Non-Family Households—Total Population Estimate	ACS
IPR2a	Ratio of Income to Poverty in Past 12 months (2 and above)	ACS
MedianHHIn	Median Household Income per Year (in USD)	ACS

Table 29. Descriptive statistics of key variables

Variable	Min.	Max.	Mean	Std. Dev.	IQR	Median
Arrests	0	245	6.933	12.717	7	3
Pop	0	8320	1343.550	846.185	921	1162
HH	0	2829	500.618	295.642	327.5	437
M25_34	0	1585	96.522	95.535	87	72
RAC	0	3561	538.870	335.255	358.5	459
WAC	0	27382	543.725	1265.321	447	177
OD_Avg	0	14047	532.631	679.468	384	358
OnS_Sell	0	91	1.697	3.407	2	1
OffS_Sell	0	34	1.499	2.332	2	1
Intrsec	0	110	13.185	15.718	20	7
Alc_Cr	0	11	0.483	0.930	1	0
Alc_K	0	22	0.888	1.369	1	0
Alc_KA	0	6641	279.014	375.138	247	162
All_Cr	0	25	1.189	1.836	2	1
All_K	0	89	3.137	4.098	3	2
All_KA	0	245	6.933	12.717	7	3

Note: RAC = residence area characteristic; WAC = work area characteristic; Sample size = 3,471.

Figure 23. Correlation plot (alcohol-involved crashes)

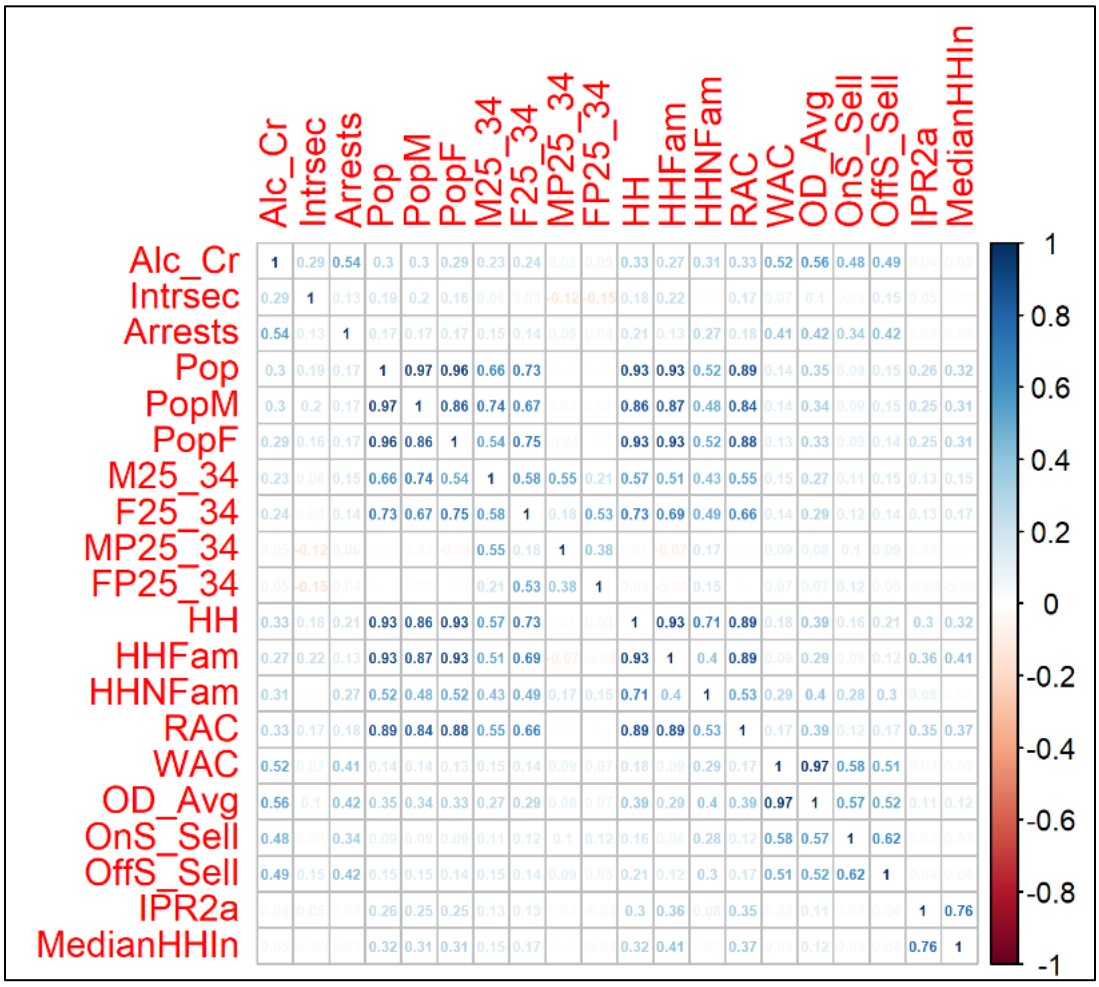


Figure 24. Correlation plot (all crashes)

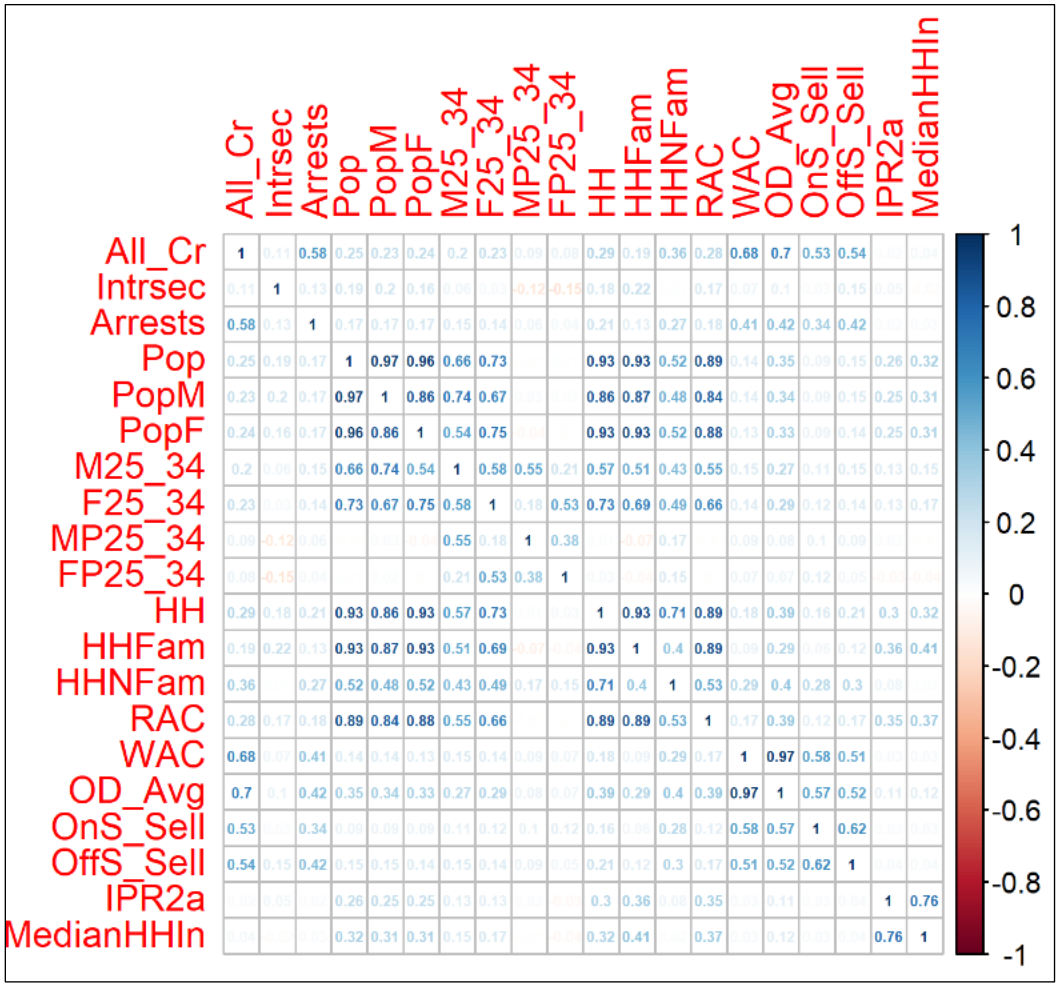


Figure 25. Correlation plot (alcohol-involved KA crashes)

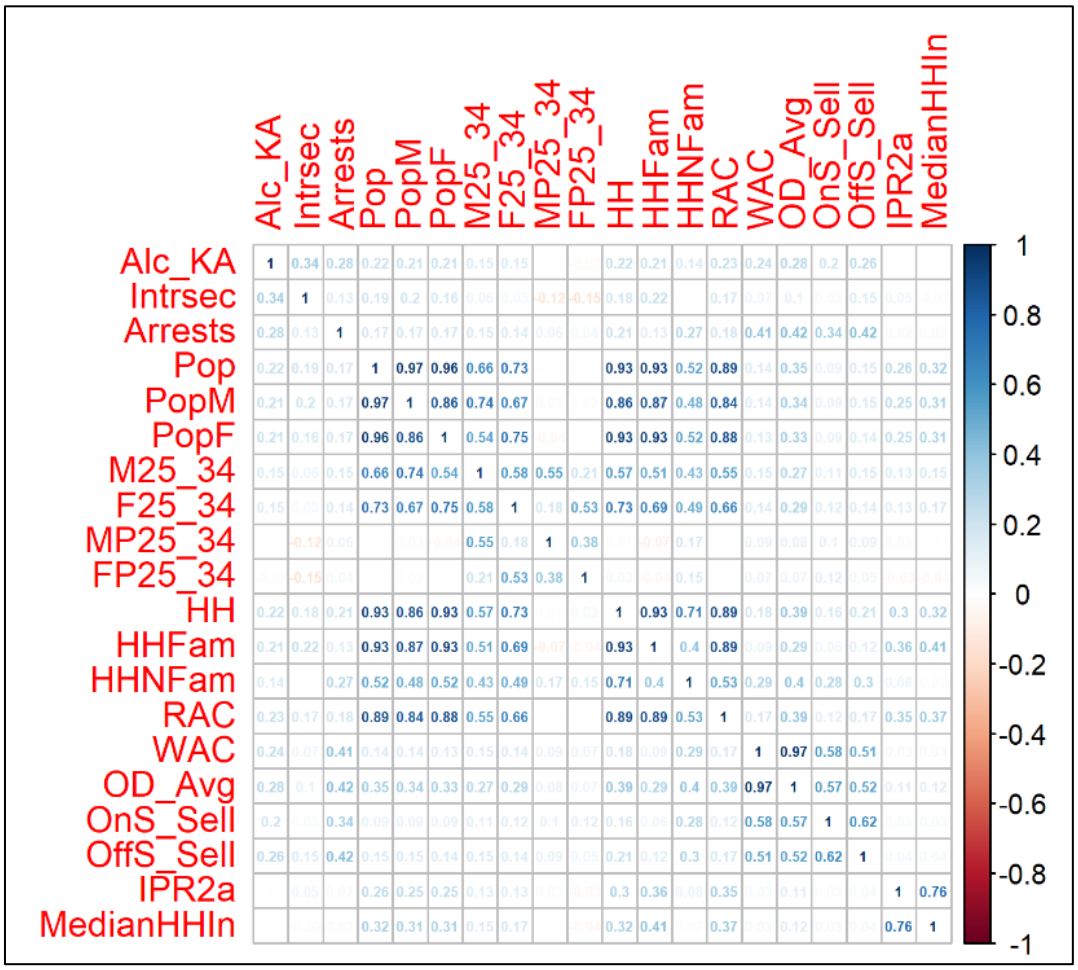


Figure 26. Correlation plot (all KA crashes)

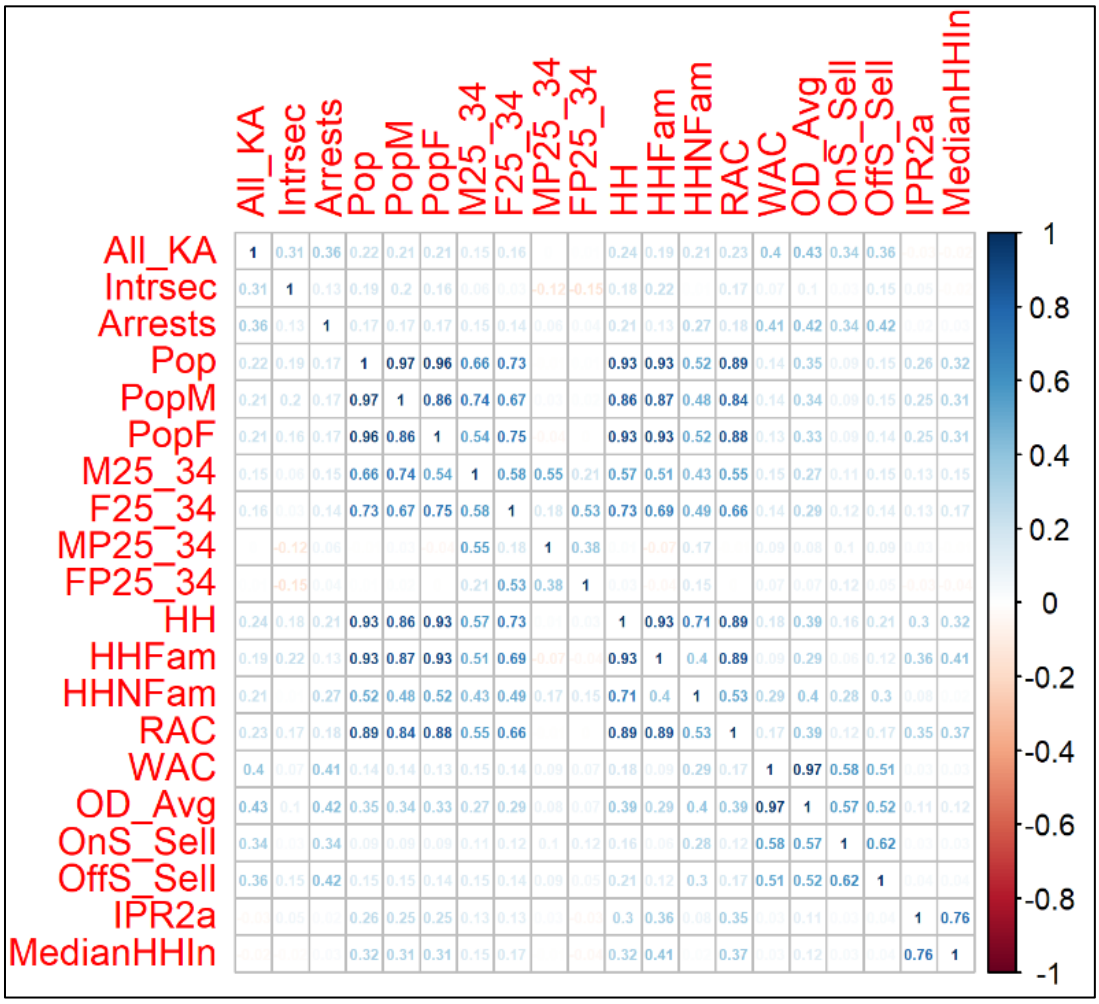


Figure 27. Correlation plot (alcohol-involved K crashes)

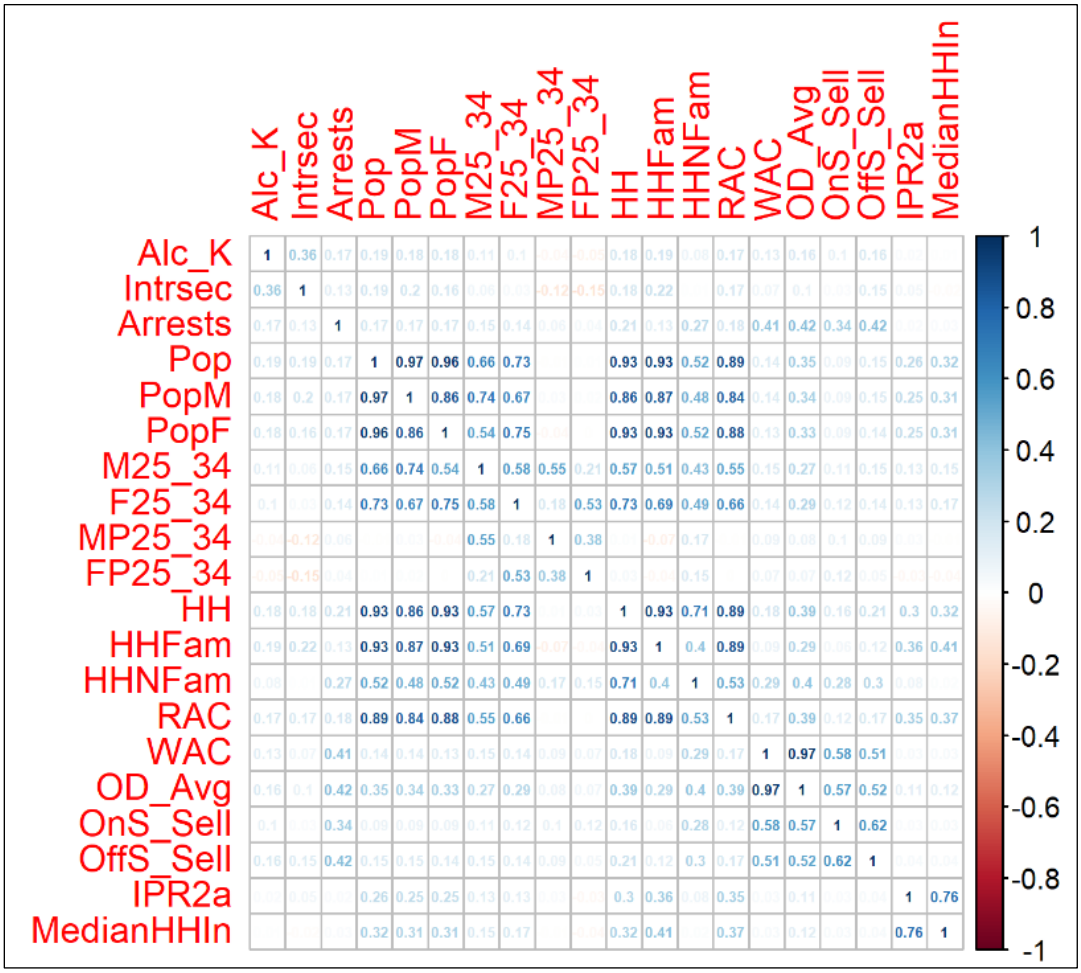
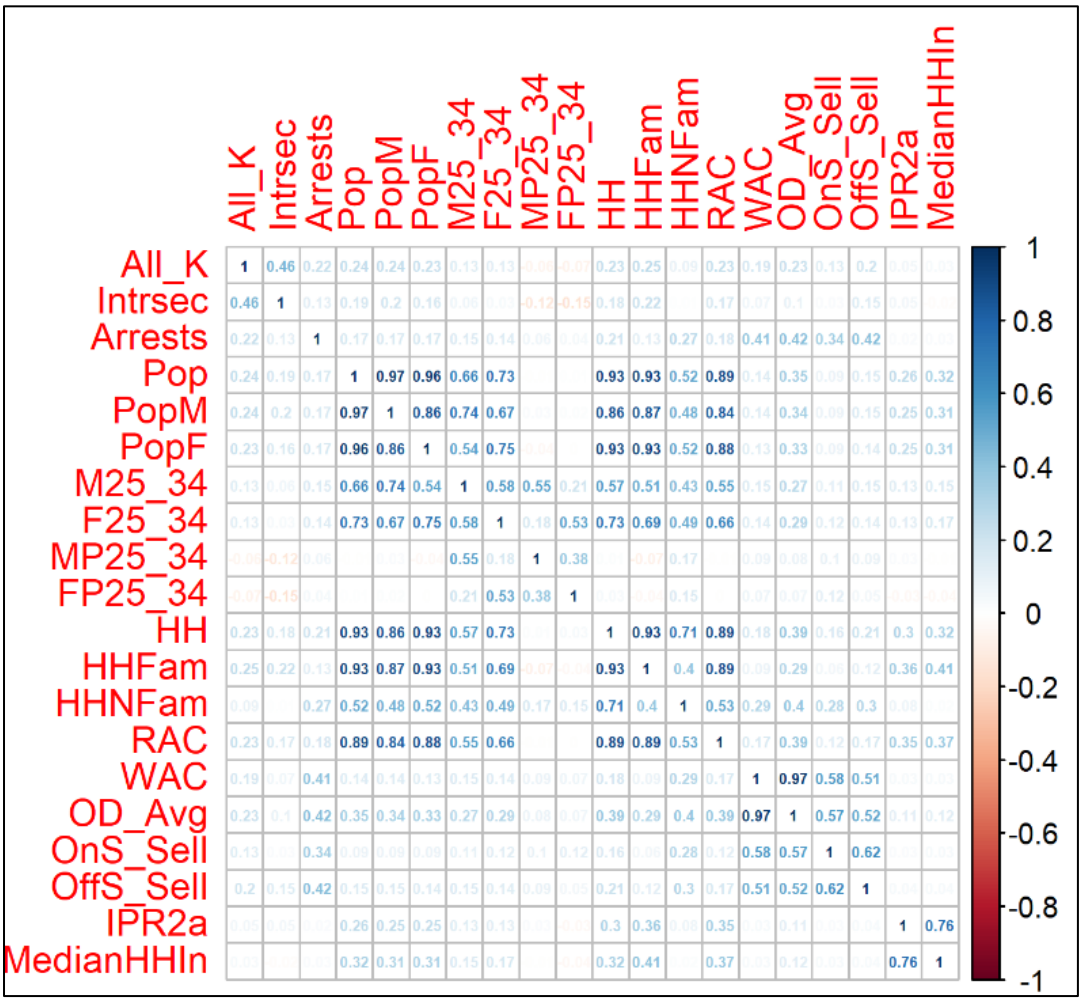


Figure 28. Correlation plot (all K crashes)



Appendix G

Figure 29. Box and violin plots of household, male/female 25–34 years, and RAC

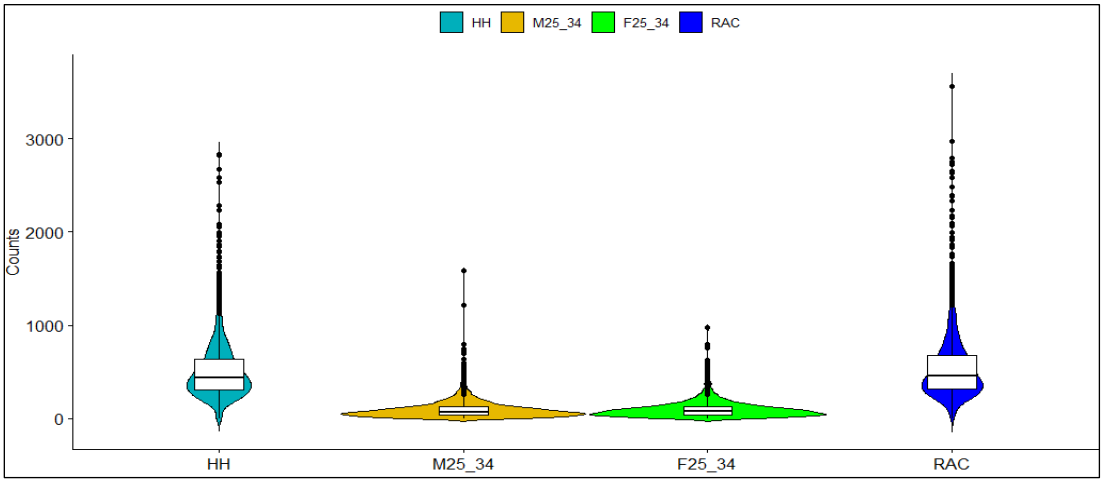


Figure 30. Box and violin plots of population and OD average jobs

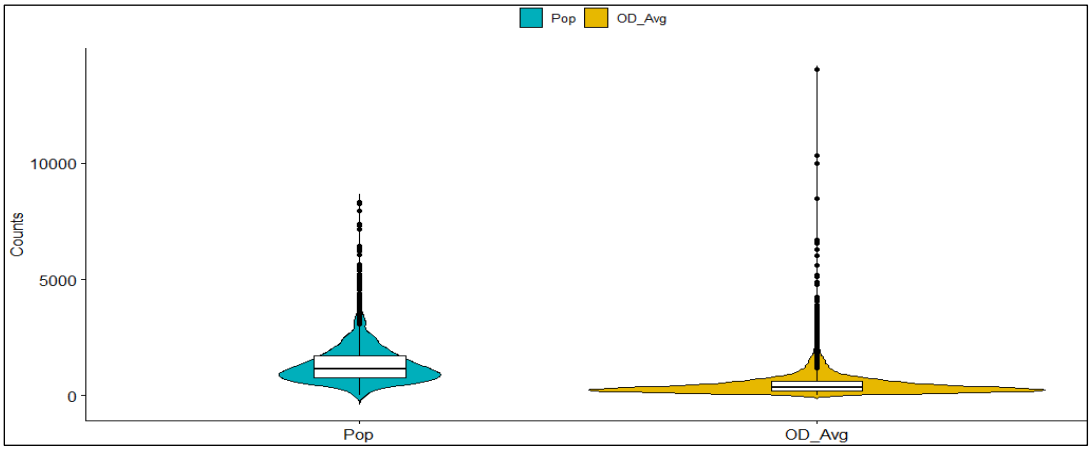
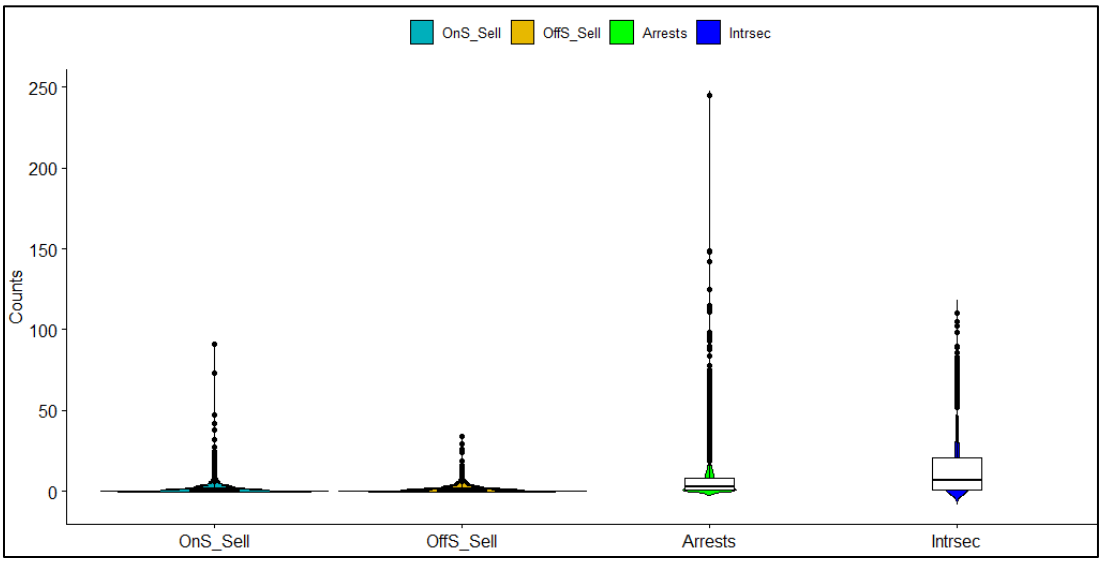


Figure 31. Box and violin plots of alcohol sellers, arrests, and intersections



Appendix H

This section documents the systemic analysis results using KA and all (KABCO) alcohol-involved crashes. The figures below show the proportion of KA and all alcohol-involved crashes as a function of each risk factor.

Figure 32. Proportion of KA alcohol-involved crashes as a function of off-site alcohol sellers

Figure 33. Proportion of KA alcohol-involved crashes as a function of the number of arrests

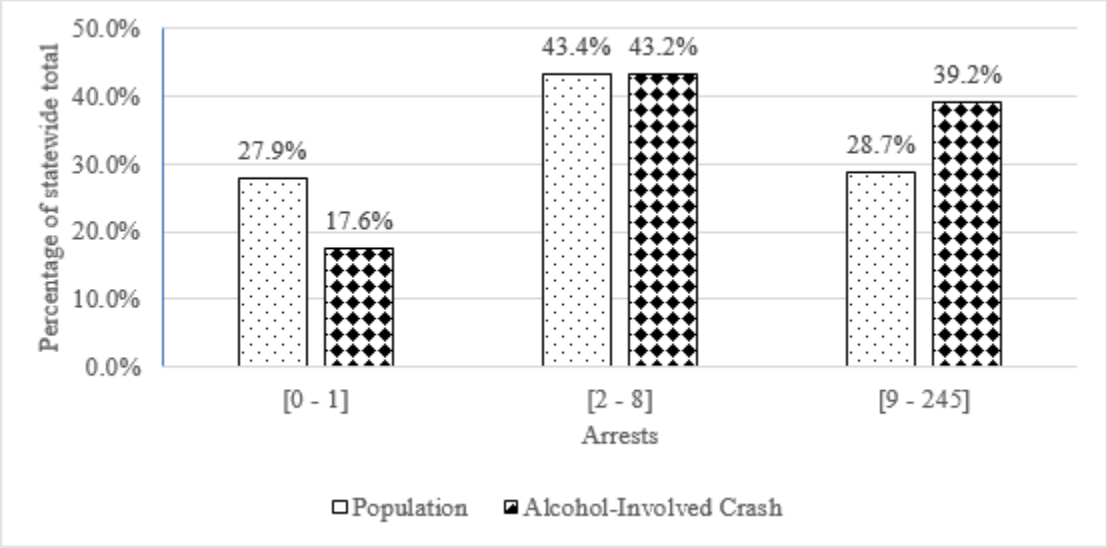


Figure 34. Proportion of KA alcohol-involved crashes as a function of number of intersections

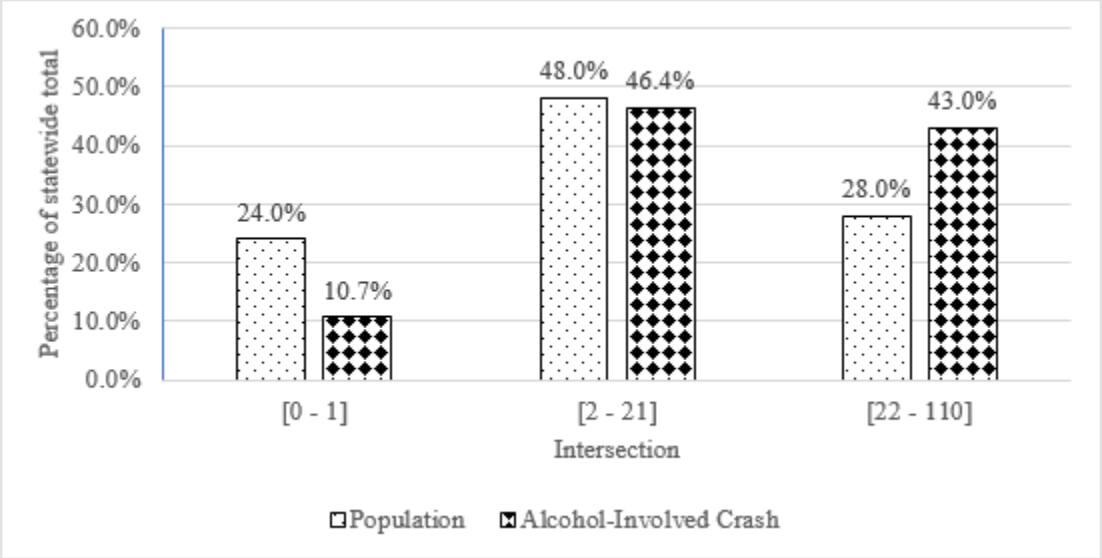


Figure 35. Proportion of KA alcohol-involved crashes as a function of average number of jobs

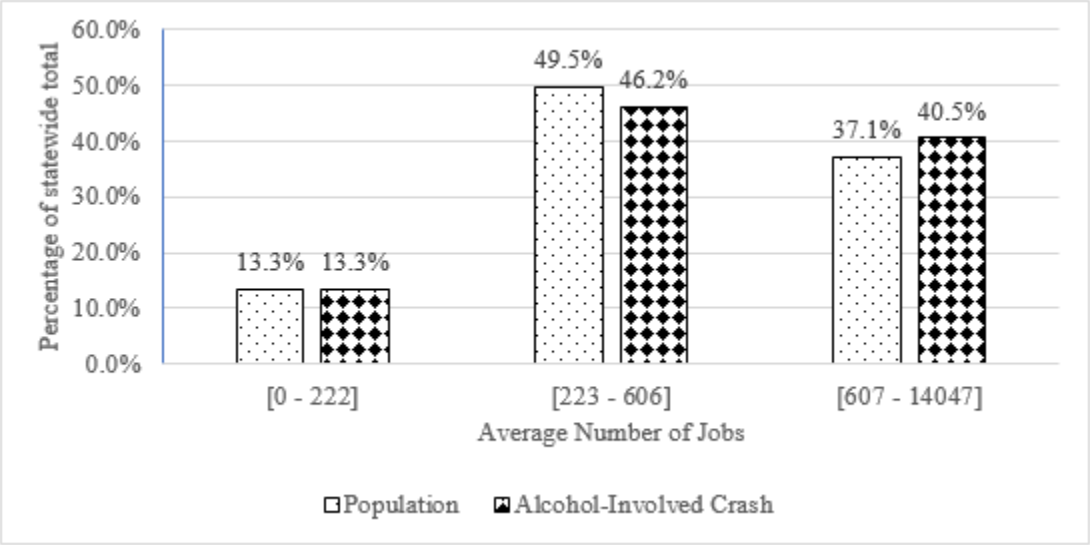


Figure 36. Proportion of KA alcohol-involved crashes as a function of population of males (24–35 years)

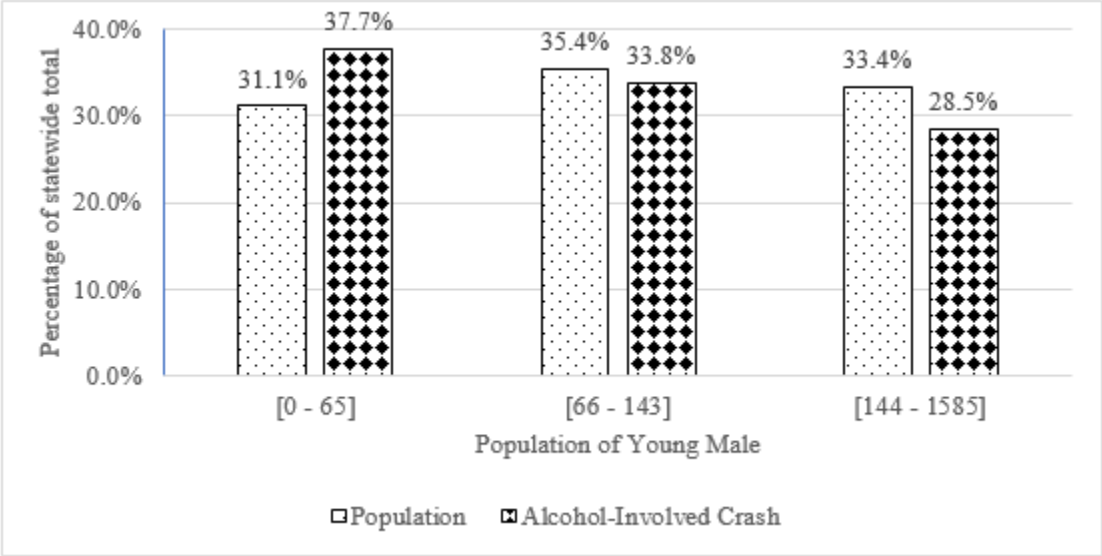


Figure 37. Proportion of KA alcohol-involved crashes as a function of number of households

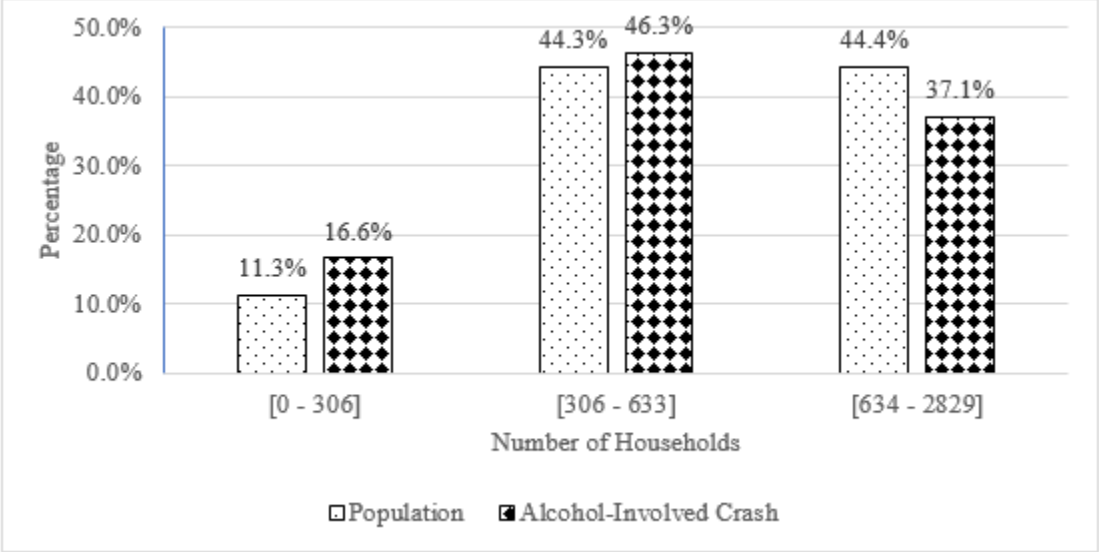


Figure 38. Proportion of KA alcohol-involved crashes as a function of residence area characteristic

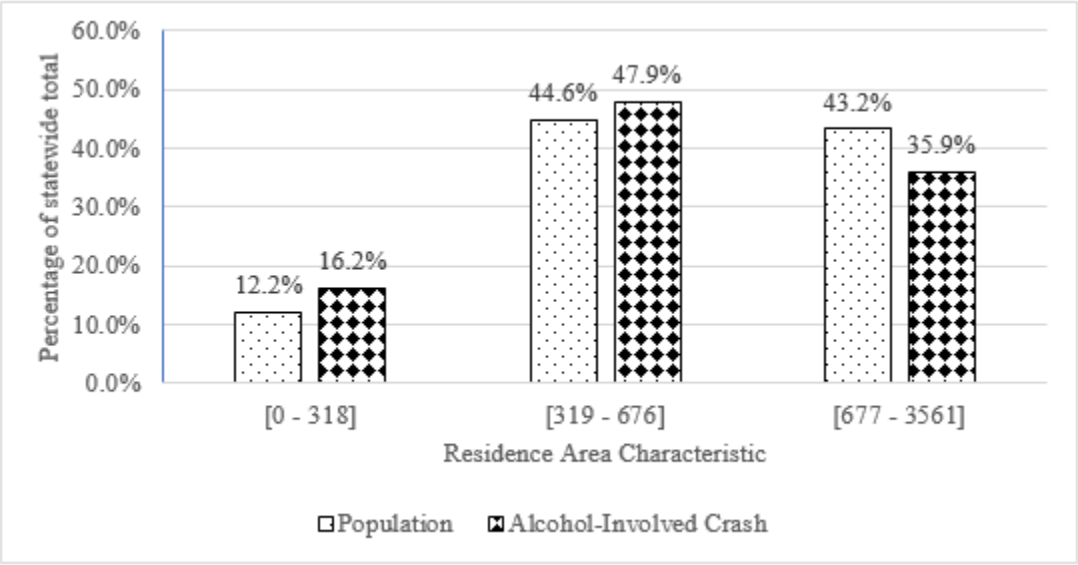


Figure 39. Proportion of KA alcohol-involved crashes as a function of work area characteristic

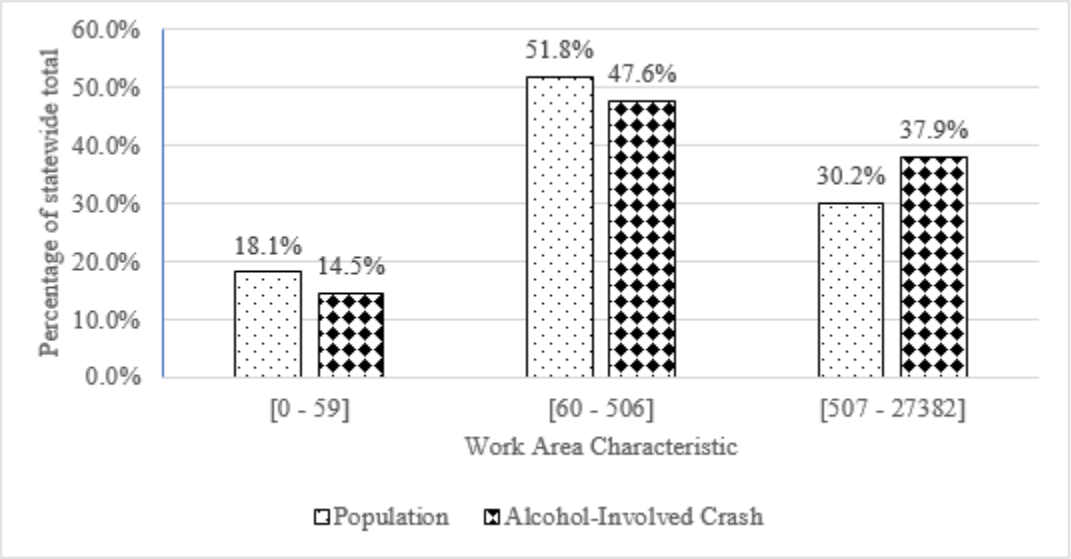


Figure 40. Proportion of all alcohol-involved crashes as a function of on-site alcohol sellers

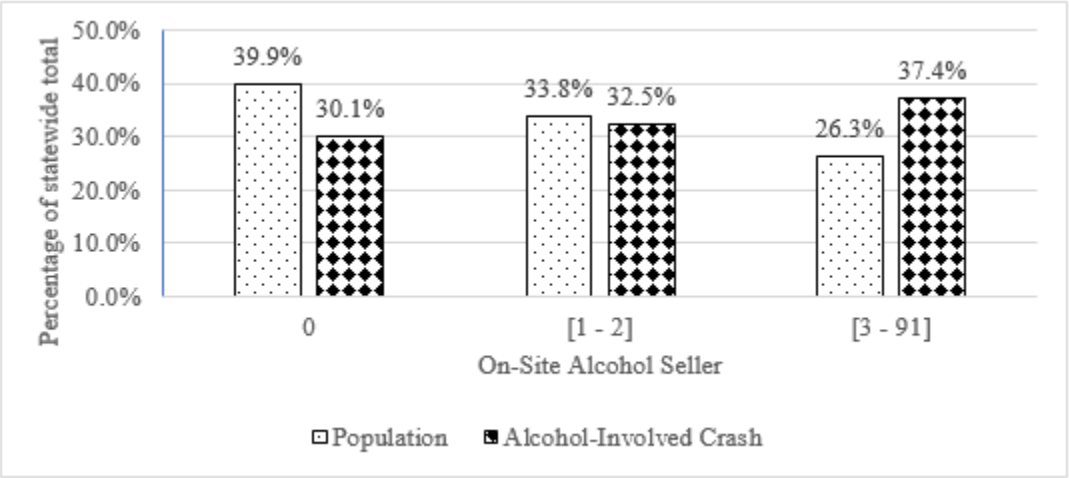


Figure 41. Proportion of all alcohol-involved crashes as a function of off-site alcohol sellers

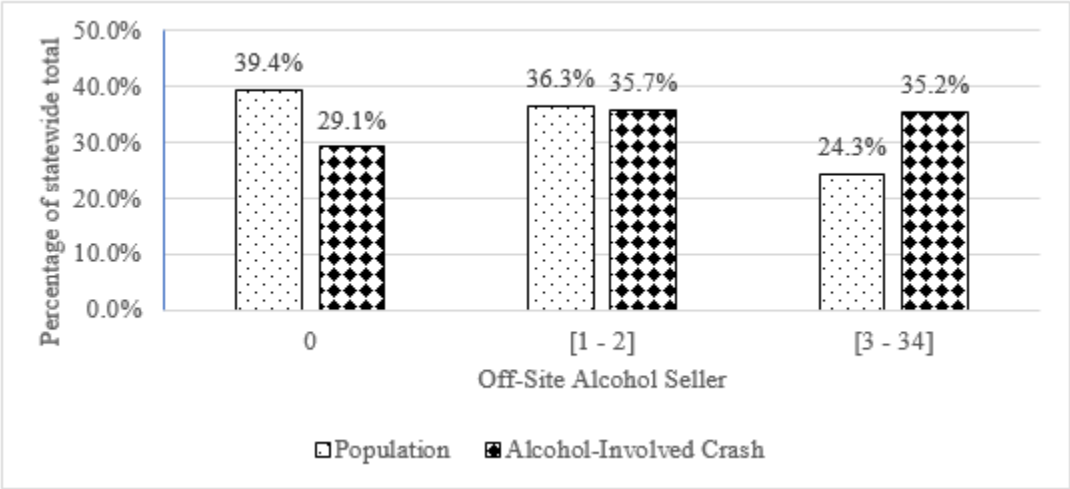


Figure 42. Proportion of all alcohol-involved crashes as a function of arrests

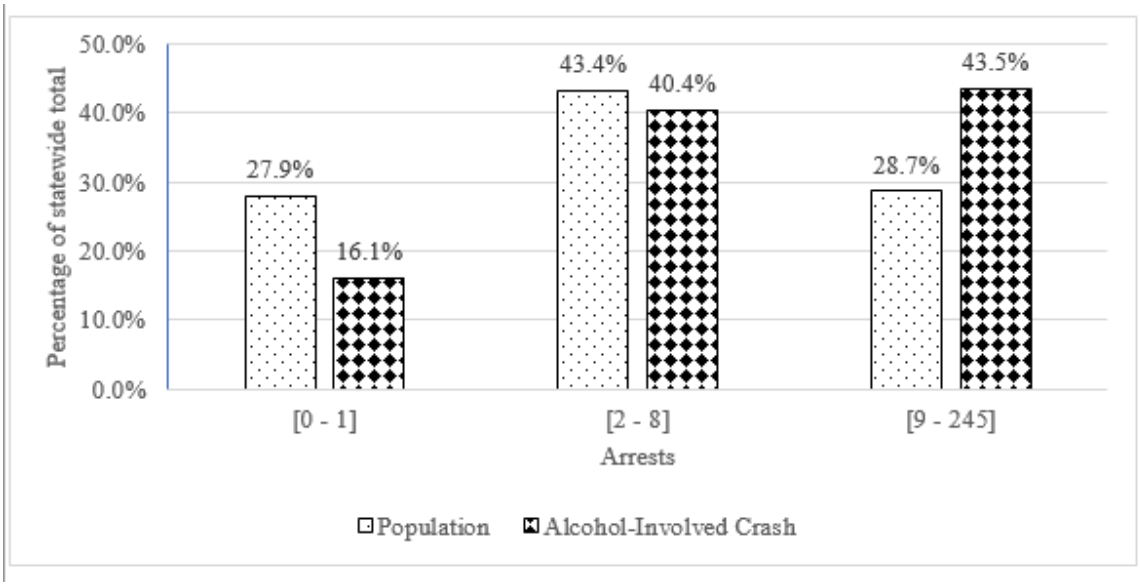


Figure 43. Proportion of all alcohol-involved crashes as a function of intersection number

Figure 44. Proportion of all alcohol-involved crashes as a function of job frequency

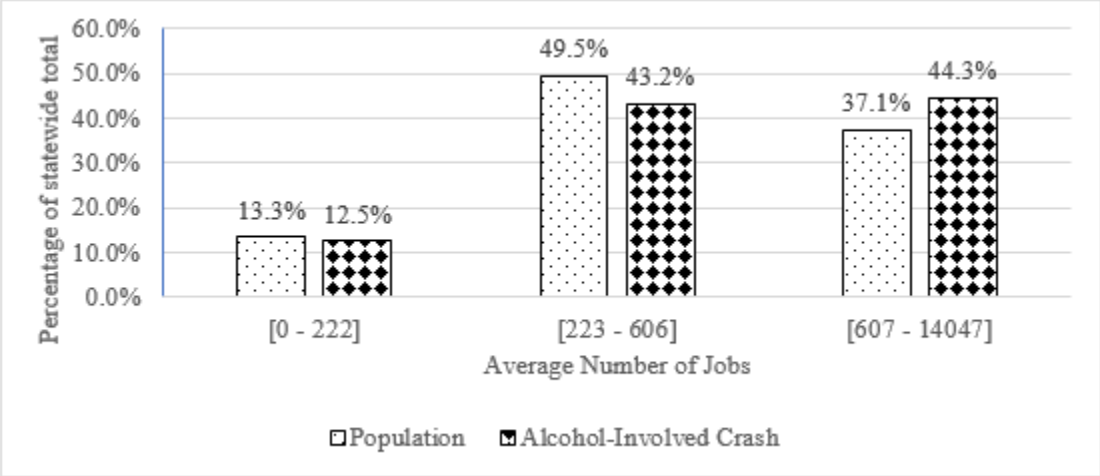


Figure 45. Proportion of all alcohol-involved crashes as a function of young male population

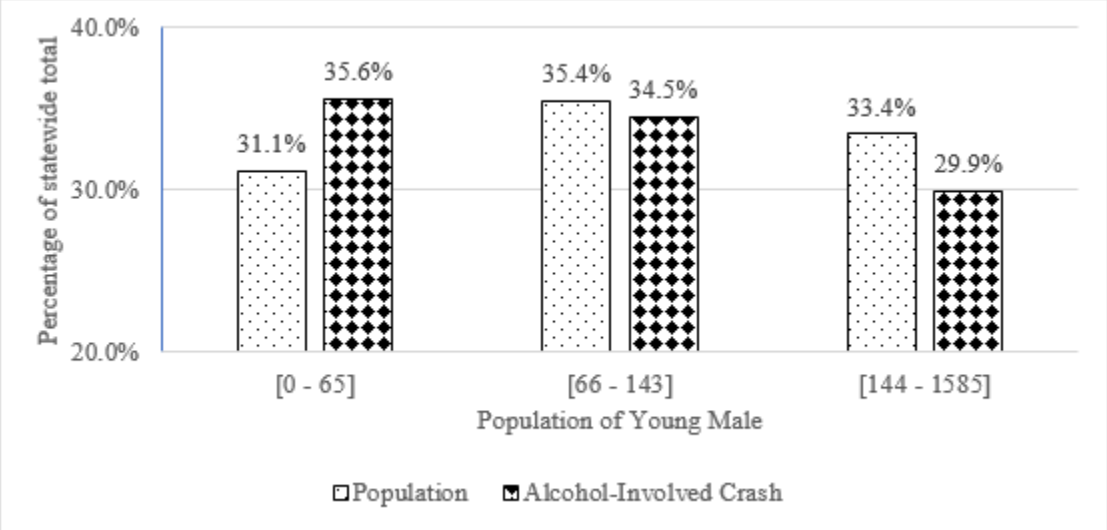


Figure 46. Proportion of all alcohol-involved crashes as a function of number of households

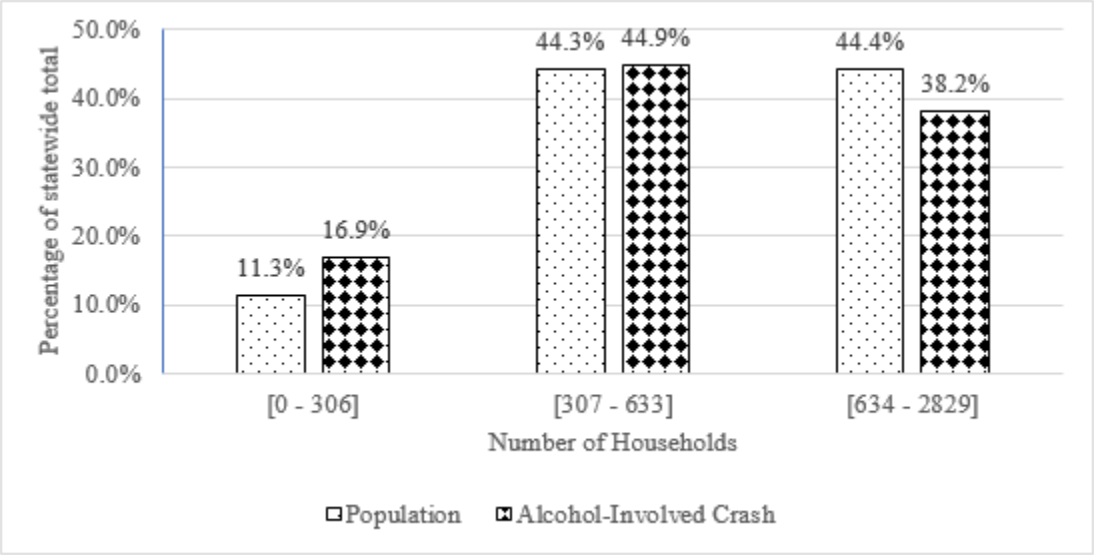


Figure 47. Proportion of all alcohol-involved crashes as a function of residence area characteristic

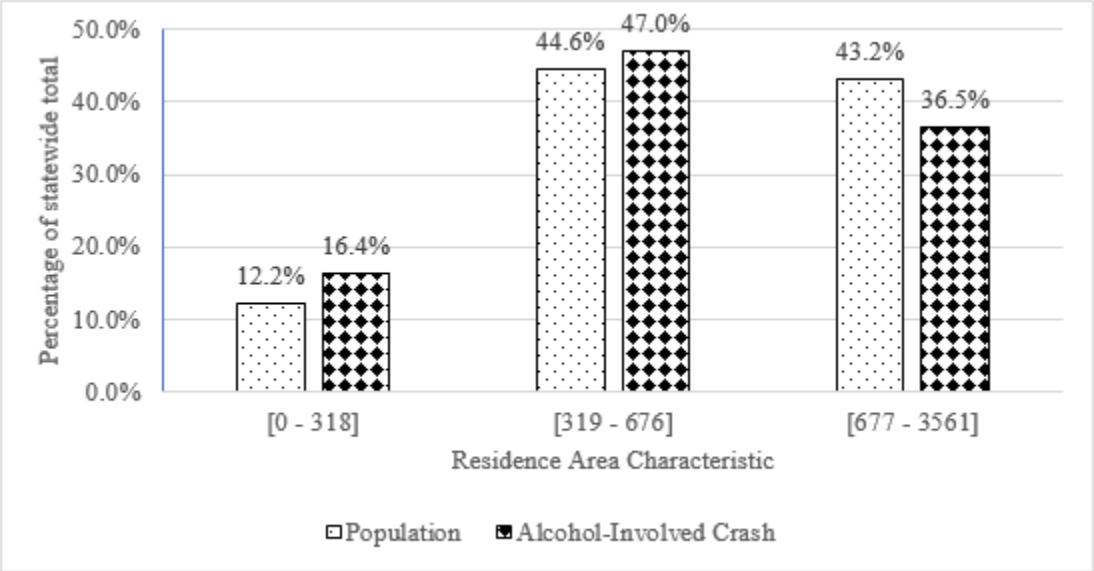


Figure 48. Proportion of all alcohol-involved crashes as a function of work area characteristic

Table 30. Risk factor weight points (alcohol-involved KABCO crashes)

Variable	Level	Range	Weight Points
On-Site Alcohol Seller	Low	0	4
	Moderate	[1–2]	12
	High	[3–91]	23
Off-Site Alcohol Seller	Low	0	2
	Moderate	[1–2]	12
	High	[3–34]	23
Number of Arrests	Low	[0–1]	1
	Moderate	[2–8]	11
	High	[9–245]	24
Number of Intersections	Low	[0–1]	2
	Moderate	[2–21]	15
	High	[22–110]	20
Average Number of Jobs	Low	[0–222]	10
	Moderate	[223–606]	8
	High	[607–14,047]	21
Population of Males (25–34 years)	Low	[0–38]	17
	Moderate	[39–125]	12
	High	[126–1585]	9
Number of Households	Low	[0–306]	16
	Moderate	[307–633]	15
	High	[634–2829]	7
Residence Area Characteristic	Low	[0–318]	15
	Moderate	[319–676]	16
	High	[677–3561]	7
Work Area Characteristic	Low	[0–59]	7
	Moderate	[60–506]	8
	High	[507–27,382]	24

Appendix I

Table 31. Top 50 block groups with the highest total points (KA)

GEOID	Parish	CT	ON	OFF	ARR	INT	OD	YM	HH	RAC	WAC	Total Points
220850005004	Sabine	2	4	3	11	24	636	50	280	353	963	178
220730106031	Ouachita	9	9	5	45	35	2200	65	369	342	4068	177
220190016004	Calcasieu	6	3	5	19	46	890	30	369	383	1413	177
220170253001	Caddo	5	22	15	245	34	5188	44	405	337	10049	177
220190036002	Calcasieu	2	5	6	10	27	650	62	432	390	958	177
220399504002	Evangeline	1	3	10	15	42	686	38	393	530	849	177
221090009002	Terrebonne	0	6	5	74	26	1654	14	446	433	2882	177
221090009004	Terrebonne	0	6	3	21	31	678	0	324	533	860	177
220710017511	Orleans	22	8	8	40	72	3097	57	273	282	5921	176
220790139002	Rapides	3	7	4	37	36	611	0	285	246	980	176
220730108001	Ouachita	2	12	11	95	28	4894	32	393	297	9499	175
220330052002	East Baton Rouge	8	5	3	113	27	3402	77	459	541	6269	170
220550014111	Lafayette	6	15	4	14	38	6700	101	559	501	12904	170
220730108002	Ouachita	5	7	9	35	25	2477	72	423	487	4479	170
220950710001	St. John the Baptist	4	9	13	97	46	901	84	554	589	1222	170
220790105003	Rapides	3	4	2	24	23	669	0	239	458	889	170
221030411031	St. Tammany	3	6	4	17	23	704	93	492	581	851	170
220790128001	Rapides	2	3	5	27	28	749	92	373	468	1038	170
220570212002	Lafourche	1	6	7	35	41	1404	95	480	614	2208	170
220730058001	Ouachita	1	4	4	11	27	918	101	504	580	1276	170
221030405012	St. Tammany	1	9	6	10	28	834	111	415	388	1290	170
221059547001	Tangipahoa	1	6	5	17	22	758	109	562	649	879	170
220479531021	Iberville	0	10	3	14	22	394	25	165	265	528	170
220570212001	Lafourche	0	6	4	10	57	1508	89	611	629	2396	170
220619605002	Lincoln	0	6	6	10	27	1810	93	435	585	3060	170
220730058002	Ouachita	0	8	10	41	36	2396	83	488	476	4330	170
220630406006	Livingston	7	5	1	39	25	1379	27	378	372	2390	169
220550011004	Lafayette	0	3	2	18	30	752	14	527	475	1035	169
220570214001	Lafourche	0	6	2	20	35	638	34	333	456	827	169
220979606004	St. Landry	5	6	3	14	47	932	65	646	665	1207	168
220990206004	St. Martin	6	12	9	6	38	2188	25	424	573	3811	167
220050304012	Ascension	2	3	7	33	11	724	49	252	355	1098	167
220019608003	Acadia	0	4	5	8	23	624	60	441	424	830	167
220790126001	Rapides	0	10	8	12	16	2422	44	286	430	4424	167
220019606001	Acadia	5	5	10	10	25	746	31	596	863	651	166
220019608001	Acadia	3	7	8	11	38	1888	65	591	861	2956	166

GEOID	Parish	CT	ON	OFF	ARR	INT	OD	YM	HH	RAC	WAC	Total Points
220330040091	East Baton Rouge	3	7	3	28	14	2675	54	470	635	4722	166
220730017001	Ouachita	2	5	3	11	6	1462	18	431	579	2384	166
221090017003	Terrebonne	2	15	16	21	26	3008	145	504	425	5597	166
220150104002	Caddo	1	7	3	52	7	2028	22	356	363	3705	166
220190001002	Calcasieu	1	3	6	13	2	2920	58	522	387	5462	166
220730053022	Ouachita	1	5	5	12	11	688	41	595	532	881	166
221030407092	St. Tammany	1	5	4	11	3	1172	18	631	658	1728	166
220150106014	Bossier	0	9	3	13	10	2153	25	447	328	3989	166
220330038021	East Baton Rouge	0	4	6	14	14	2078	59	470	415	3747	166
220150108052	Bossier	4	11	4	15	6	848	0	410	300	1409	164
221030406021	St. Tammany	1	6	4	10	6	966	32	371	297	1644	164
221010410002	St. Mary	2	3	2	18	35	534	60	442	513	562	163
221179505002	Washington	2	0	9	14	35	880	55	434	449	1321	163
221179509001	Washington	2	0	11	41	35	988	37	577	434	1566	163

Note: CT = KA Alcohol-Involved Crashes (2013–2018); ON = On-Site Alcohol Sellers; OFF = Off-Site Alcohol Sellers; ARR = Arrested Cases; INT = Intersection Number; OD = Origin-Destination; YM = Population of Young Males (24–35); HH = Households; RAC = Residence Area Characteristic; WAC = Work Area Characteristic.

Figure 49. Top 50 block groups with the highest total points

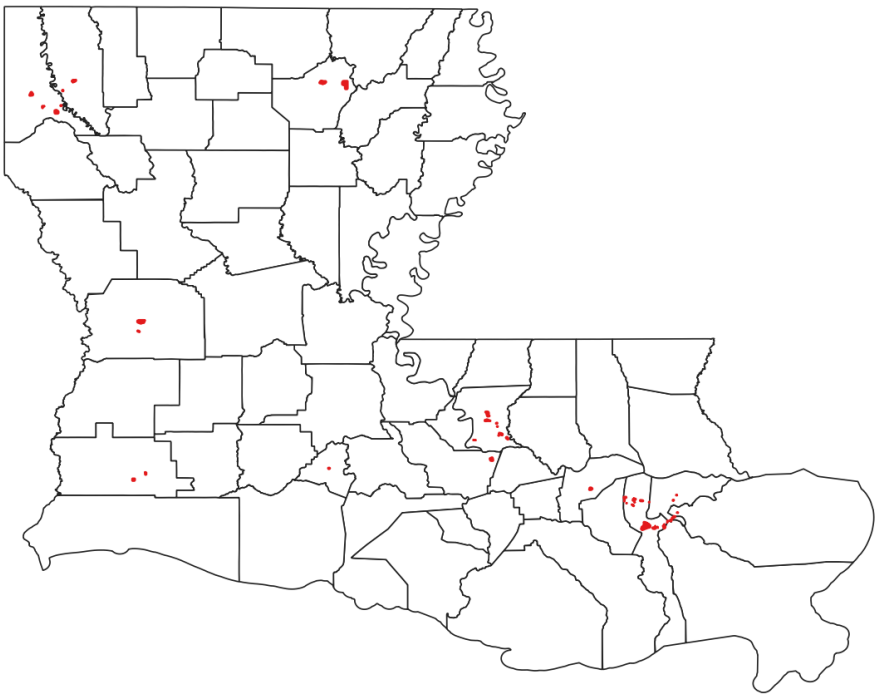


Table 32. Number and percentage of block groups with the risk levels in each parish

Parish	Number and Percentage of Block Groups with Risk Levels			Number of Block Groups	Total Points
	Low	Medium	High		
Acadia	1 (2.1%)	34 (72.3%)	12 (25.5%)	47	5,549
Allen	5 (27.8%)	10 (55.6%)	3 (16.7%)	18	1,910
Ascension	1 (2.4%)	18 (42.9%)	23 (54.8%)	42	5,361
Assumption	3 (17.6%)	10 (58.8%)	4 (23.5%)	17	1,935
Avoyelles	2 (6.3%)	15 (46.9%)	15 (46.9%)	32	3,941
Beauregard	9 (39.1%)	12 (52.2%)	2 (8.7%)	23	2,340
Bienville	0 (0%)	10 (62.5%)	6 (37.5%)	16	1,949
Bossier	22 (31%)	28 (39.4%)	21 (29.6%)	71	7,708
Caddo	58 (29.3%)	100 (50.5%)	40 (20.2%)	198	21,126
Calcasieu	29 (21%)	78 (56.5%)	31 (22.5%)	138	15,145
Caldwell	0 (0%)	6 (66.7%)	3 (33.3%)	9	1,077
Cameron	1 (11.1%)	5 (55.6%)	3 (33.3%)	9	1,034
Catahoula	1 (12.5%)	3 (37.5%)	4 (50%)	8	945
Claiborne	3 (18.8%)	9 (56.3%)	4 (25%)	16	1,804
Concordia	3 (16.7%)	8 (44.4%)	7 (38.9%)	18	2,149
De Soto	0 (0%)	16 (72.7%)	6 (27.3%)	22	2,632
East Baton Rouge	76 (25.1%)	143 (47.2%)	84 (27.7%)	303	33,335
East Carroll	1 (12.5%)	6 (75%)	1 (12.5%)	8	918
East Feliciana	1 (6.3%)	9 (56.3%)	6 (37.5%)	16	1,856
Evangeline	2 (6.7%)	19 (63.3%)	9 (30%)	30	3,519
Franklin	0 (0%)	17 (94.4%)	1 (5.6%)	18	1,973
Grant	2 (13.3%)	12 (80%)	1 (6.7%)	15	1,684
Iberia	11 (20.4%)	36 (66.7%)	7 (13%)	54	5,825
Iberville	1 (4.5%)	12 (54.5%)	9 (40.9%)	22	2,687
Jackson	3 (21.4%)	11 (78.6%)	0 (0%)	14	1,455
Jefferson	125 (37.7%)	129 (38.9%)	78 (23.5%)	332	34,502
Jefferson Davis	3 (11.5%)	18 (69.2%)	5 (19.2%)	26	2,904
La Salle	2 (14.3%)	7 (50%)	5 (35.7%)	14	1,609
Lafayette	27 (20.8%)	59 (45.4%)	44 (33.8%)	130	14,708
Lafourche	6 (8.6%)	42 (60%)	22 (31.4%)	70	8,327
Lincoln	8 (24.2%)	18 (54.5%)	7 (21.2%)	33	3,603
Livingston	10 (18.5%)	27 (50%)	17 (31.5%)	54	6,179
Madison	4 (40%)	4 (40%)	2 (20%)	10	1,046
Morehouse	5 (20%)	18 (72%)	2 (8%)	25	2,569

Parish	Number and Percentage of Block Groups with Risk Levels			Number of Block Groups	Total Points
	Low	Medium	High		
Natchitoches	1 (2.9%)	22 (62.9%)	12 (34.3%)	35	4,185
Orleans	250 (50.3%)	194 (39%)	53 (10.7%)	497	48,449
Ouachita	36 (31.9%)	49 (43.4%)	28 (24.8%)	113	12,420
Plaquemines	3 (13%)	13 (56.5%)	7 (30.4%)	23	2,608
Pointe Coupee	0 (0%)	7 (43.8%)	9 (56.3%)	16	2,021
Rapides	11 (11.3%)	50 (51.5%)	36 (37.1%)	97	11,371
Red River	0 (0%)	4 (50%)	4 (50%)	8	1,029
Richland	3 (17.6%)	12 (70.6%)	2 (11.8%)	17	1,812
Sabine	1 (4.3%)	13 (56.5%)	9 (39.1%)	23	2,741
St. Bernard	15 (30%)	25 (50%)	10 (20%)	50	5,344
St. Charles	9 (26.5%)	13 (38.2%)	12 (35.3%)	34	3,869
St. Helena	0 (0%)	2 (22.2%)	7 (77.8%)	9	1,190
St. James	0 (0%)	12 (66.7%)	6 (33.3%)	18	2,197
St. John the Baptist	9 (30%)	12 (40%)	9 (30%)	30	3,312
St. Landry	8 (12.1%)	38 (57.6%)	20 (30.3%)	66	7,831
St. Martin	1 (3.1%)	20 (62.5%)	11 (34.4%)	32	3,899
St. Mary	13 (28.3%)	17 (37%)	16 (34.8%)	46	5,091
St. Tammany	21 (16.7%)	50 (39.7%)	55 (43.7%)	126	14,940
Tangipahoa	6 (9.1%)	36 (54.5%)	24 (36.4%)	66	7,919
Tensas	0 (0%)	5 (83.3%)	1 (16.7%)	6	682
Terrebonne	11 (14.3%)	33 (42.9%)	33 (42.9%)	77	9,313
Union	2 (10.5%)	13 (68.4%)	4 (21.1%)	19	2,187
Vermilion	7 (15.9%)	28 (63.6%)	9 (20.5%)	44	4,876
Vernon	15 (34.1%)	21 (47.7%)	8 (18.2%)	44	4,507
Washington	2 (6.7%)	15 (50%)	13 (43.3%)	30	3,621
Webster	6 (15.4%)	24 (61.5%)	9 (23.1%)	39	4,296
West Baton Rouge	2 (14.3%)	6 (42.9%)	6 (42.9%)	14	1,658
West Carroll	3 (27.3%)	8 (72.7%)	0 (0%)	11	1,079
West Feliciana	3 (42.9%)	3 (42.9%)	1 (14.3%)	7	777
Winn	0 (0%)	13 (81.3%)	3 (18.8%)	16	1,825

Note: Total Points = sum of points of block groups within the parish.

Table 33. Number and percentage of block groups with the risk levels in each parish (sorted by highest percentage)

Parish	Number and Percentage of Block Groups with Risk Levels			Number of Block Groups	Total Points
	Low	Medium	High		
St. Helena	0 (0%)	2 (22.2%)	7 (77.8%)	9	1,190
Pointe Coupee	0 (0%)	7 (43.8%)	9 (56.3%)	16	2,021
Ascension	1 (2.4%)	18 (42.9%)	23 (54.8%)	42	5,361
Catahoula	1 (12.5%)	3 (37.5%)	4 (50%)	8	945
Red River	0 (0%)	4 (50%)	4 (50%)	8	1,029
Avoyelles	2 (6.3%)	15 (46.9%)	15 (46.9%)	32	3,941
St. Tammany	21 (16.7%)	50 (39.7%)	55 (43.7%)	126	14,940
Washington	2 (6.7%)	15 (50%)	13 (43.3%)	30	3,621
Terrebonne	11 (14.3%)	33 (42.9%)	33 (42.9%)	77	9,313
West Baton Rouge	2 (14.3%)	6 (42.9%)	6 (42.9%)	14	1,658
Iberville	1 (4.5%)	12 (54.5%)	9 (40.9%)	22	2,687
Sabine	1 (4.3%)	13 (56.5%)	9 (39.1%)	23	2,741
Concordia	3 (16.7%)	8 (44.4%)	7 (38.9%)	18	2,149
Bienville	0 (0%)	10 (62.5%)	6 (37.5%)	16	1,949
East Feliciana	1 (6.3%)	9 (56.3%)	6 (37.5%)	16	1,856
Rapides	11 (11.3%)	50 (51.5%)	36 (37.1%)	97	11,371
Tangipahoa	6 (9.1%)	36 (54.5%)	24 (36.4%)	66	7,919
La Salle	2 (14.3%)	7 (50%)	5 (35.7%)	14	1,609
St. Charles	9 (26.5%)	13 (38.2%)	12 (35.3%)	34	3,869
St. Mary	13 (28.3%)	17 (37%)	16 (34.8%)	46	5,091
St. Martin	1 (3.1%)	20 (62.5%)	11 (34.4%)	32	3,899
Natchitoches	1 (2.9%)	22 (62.9%)	12 (34.3%)	35	4,185
Lafayette	27 (20.8%)	59 (45.4%)	44 (33.8%)	130	14,708
Caldwell	0 (0%)	6 (66.7%)	3 (33.3%)	9	1,077
Cameron	1 (11.1%)	5 (55.6%)	3 (33.3%)	9	1,034
St. James	0 (0%)	12 (66.7%)	6 (33.3%)	18	2,197
Livingston	10 (18.5%)	27 (50%)	17 (31.5%)	54	6,179
Lafourche	6 (8.6%)	42 (60%)	22 (31.4%)	70	8,327
Plaquemines	3 (13%)	13 (56.5%)	7 (30.4%)	23	2,608
St. Landry	8 (12.1%)	38 (57.6%)	20 (30.3%)	66	7,831
Evangeline	2 (6.7%)	19 (63.3%)	9 (30%)	30	3,519
St. John the Baptist	9 (30%)	12 (40%)	9 (30%)	30	3,312

Parish	Number and Percentage of Block Groups with Risk Levels			Number of Block Groups	Total Points
	Low	Medium	High		
Bossier	22 (31%)	28 (39.4%)	21 (29.6%)	71	7,708
East Baton Rouge	76 (25.1%)	143 (47.2%)	84 (27.7%)	303	33,335
De Soto	0 (0%)	16 (72.7%)	6 (27.3%)	22	2,632
Acadia	1 (2.1%)	34 (72.3%)	12 (25.5%)	47	5,549
Claiborne	3 (18.8%)	9 (56.3%)	4 (25%)	16	1,804
Ouachita	36 (31.9%)	49 (43.4%)	28 (24.8%)	113	12,420
Assumption	3 (17.6%)	10 (58.8%)	4 (23.5%)	17	1,935
Jefferson	125 (37.7%)	129 (38.9%)	78 (23.5%)	332	34,502
Webster	6 (15.4%)	24 (61.5%)	9 (23.1%)	39	4,296
Calcasieu	29 (21%)	78 (56.5%)	31 (22.5%)	138	15,145
Lincoln	8 (24.2%)	18 (54.5%)	7 (21.2%)	33	3,603
Union	2 (10.5%)	13 (68.4%)	4 (21.1%)	19	2,187
Vermilion	7 (15.9%)	28 (63.6%)	9 (20.5%)	44	4,876
Caddo	58 (29.3%)	100 (50.5%)	40 (20.2%)	198	21,126
Madison	4 (40%)	4 (40%)	2 (20%)	10	1,046
St. Bernard	15 (30%)	25 (50%)	10 (20%)	50	5,344
Jefferson Davis	3 (11.5%)	18 (69.2%)	5 (19.2%)	26	2,904
Winn	0 (0%)	13 (81.3%)	3 (18.8%)	16	1,825
Vernon	15 (34.1%)	21 (47.7%)	8 (18.2%)	44	4,507
Allen	5 (27.8%)	10 (55.6%)	3 (16.7%)	18	1,910
Tensas	0 (0%)	5 (83.3%)	1 (16.7%)	6	682
West Feliciana	3 (42.9%)	3 (42.9%)	1 (14.3%)	7	777
Iberia	11 (20.4%)	36 (66.7%)	7 (13%)	54	5,825
East Carroll	1 (12.5%)	6 (75%)	1 (12.5%)	8	918
Richland	3 (17.6%)	12 (70.6%)	2 (11.8%)	17	1,812
Orleans	250 (50.3%)	194 (39%)	53 (10.7%)	497	48,449
Beauregard	9 (39.1%)	12 (52.2%)	2 (8.7%)	23	2,340
Morehouse	5 (20%)	18 (72%)	2 (8%)	25	2,569
Grant	2 (13.3%)	12 (80%)	1 (6.7%)	15	1,684
Franklin	0 (0%)	17 (94.4%)	1 (5.6%)	18	1,973
Jackson	3 (21.4%)	11 (78.6%)	0 (0%)	14	1,455
West Carroll	3 (27.3%)	8 (72.7%)	0 (0%)	11	1,079

Note: Total Points = sum of points of block groups within the parish.

Table 34. Important measures and total points for each parish from block-group-level systemic analysis

Parish	No. BG	Pop.	Catholic (%)	Youth (%)	Number of Arrests	On-Site Seller	Off-Site Seller	Alc. Crash	Alc. KA Crash	Total Points
Acadia	47	61,773	48.08	9.4	41	74	86	616	38	5,549
Allen	18	25,764	18.05	8.5	4	21	22	235	21	1,910
Ascension	42	107,215	34.02	8.4	227	123	109	1,320	97	5,361
Assumption	17	23,421	57.76	9	15	27	28	255	14	1,935
Avoyelles	32	42,073	43.73	8.7	78	50	58	481	25	3,941
Beauregard	23	35,654	6.68	8.4	50	6	22	244	22	2,340
Bienville	16	14,353	0.6	8.8	20	16	13	157	9	1,949
Bossier	71	116,979	5.04	9.7	250	137	115	942	66	7,708
Caddo	198	254,969	5.65	10.1	476	272	227	2,643	220	21,126
Calcasieu	138	192,768	33.23	10.1	116	235	267	2,695	160	15,145
Caldwell	9	10,132	0.91	8.5	12	9	12	33	6	1,077
Cameron	9	6,839	55.56	8.5	10	2	18	102	4	1,034
Catahoula	8	10,407	1.11	8.9	9	14	9	83	6	945
Claiborne	16	17,195	0.5	8.8	20	8	14	94	9	1,804
Concordia	18	20,822	1.9	8.7	8	30	26	136	10	2,149
De Soto	22	26,656	3.19	8.2	38	23	13	260	24	2,632
East Baton Rouge	303	440,171	22.24	14.2	757	486	492	4,695	270	33,335
East Carroll	8	7,759	1.98	10.3	11	8	11	23	3	918
East Feliciana	16	20,267	1.36	8.9	21	7	15	74	22	1,856
Evangeline	30	33,984	57.84	9.7	41	35	37	398	23	3,519
Franklin	18	20,767	1.33	8.6	29	10	17	103	15	1,973
Grant	15	22,309	2.33	8	16	5	8	143	14	1,684
Iberia	54	73,240	53.13	9.5	55	110	66	790	48	5,825
Iberville	22	33,387	33.15	9.8	23	62	26	335	43	2,687
Jackson	14	16,274	0.92	8.8	23	21	4	54	6	1,455
Jefferson	332	432,552	34.41	9.2	646	722	435	3,918	139	34,502
Jefferson Davis	26	31,594	50.96	8.5	1	40	34	415	23	2,904
La Salle	14	14,890	0.6	9	21	14	10	119	12	1,609
Lafayette	130	221,578	45.1	12.5	340	364	255	3,099	150	14,708
Lafourche	70	96,318	57.57	10.5	262	103	149	1,003	55	8,327
Lincoln	33	46,735	3.05	24.6	66	39	39	344	16	3,603
Livingston	54	128,026	12.62	8.8	163	121	97	1,341	114	6,179
Madison	10	12,093	0.78	9.6	17	34	10	132	14	1,046
Morehouse	25	27,979	1.4	8.6	39	41	15	173	21	2,569
Natchitoches	35	39,566	11.63	15.4	96	67	23	445	27	4,185
Orleans	497	343,829	30.85	12.8	426	1036	481	5,514	302	48,449
Ouachita	113	69,518	21.62	9.57619	156	148	164	1,317	98	12,420

Parish	No. BG	Pop.	Catholic (%)	Youth (%)	Number of Arrests	On-Site Seller	Off-Site Seller	Alc. Crash	Alc. KA Crash	Total Points
Plaquemines	23	23,042	38.15	8.4	32	22	53	145	25	2,608
Pointe Coupee	16	22,802	47.4	7.9	7	48	34	179	29	2,021
Rapides	97	131,613	16.08	9	249	121	92	1,388	72	11,371
Red River	8	9,091	2.06	8.7	16	10	10	97	11	1,029
Richland	17	20,725	1.57	8.8	29	16	16	147	7	1,812
Sabine	23	24,233	20.53	8.2	31	27	18	180	18	2,741
St. Bernard	50	35,897	40.48	11.3	27	64	70	306	30	5,344
St. Charles	34	52,780	41.03	8.4	146	47	56	568	33	3,869
St. Helena	9	11,203	1.79	9.5	20	8	22	130	12	1,190
St. James	18	22,102	63.1	9.4	9	32	32	279	14	2,197
St. John the Baptist	30	45,924	33.54	9.4	114	54	53	465	35	3,312
St. Landry	66	83,384	59.04	8.9	70	138	102	1,088	70	7,831
St. Martin	32	52,160	55.24	9.1	58	114	85	709	52	3,899
St. Mary	46	54,650	32.63	9.4	51	96	66	504	36	5,091
St. Tammany	126	233,740	22.74	7.2	428	266	268	1,810	93	14,940
Tangipahoa	66	121,097	14.31	12.8	227	146	138	1,341	132	7,919
Tensas	6	5,252	1.81	7.4	7	6	11	54	6	682
Terrebonne	77	111,860	48.85	10.1	241	154	177	1,220	69	9,313
Union	19	22,721	1.93	8.6	9	1	33	195	19	2,187
Vermilion	44	57,999	55.62	8.7	34	0	126	697	44	4,876
Vernon	44	52,334	1.49	13.4	100	0	58	356	33	4,507
Washington	30	47,168	4.45	8.2	37	0	73	316	33	3,621
Webster	39	41,207	1.56	8.5	70	1	44	311	31	4,296
West Baton Rouge	14	23,788	29.85	10	34	0	90	379	38	1,658
West Carroll	11	11,604	1.21	7.9	16	0	0	66	5	1,079
West Feliciana	7	15,625	6.76	5.7	22	0	33	53	10	777
Winn	16	15,313	1.2	8.4	6	0	15	67	11	1,825

Note: No. BG = number of block groups; Pop. = population; Alc. Crash = alcohol-involved crashes; Alc. KA Crash = alcohol-involved KA crashes

Appendix J

Interactive Tool
USER MANUAL

This user manual provides guidance on the use of the interactive tool developed for *Louisiana's Alcohol-Impaired Driving Problem: An Analysis of Crash and Cultural Factors*. This tool offers features of visualizing the data on parish or U.S. census block group level, and the survey results.

Tool Link

The tool is deployed on https://ladotd.shinyapps.io/LA_Alcohol_Tool.

Interface

Figure 1 shows the interface of the introduction page of the interactive tool. This page includes a brief introduction of this project, the components of the tool, and basic steps of using the tool.

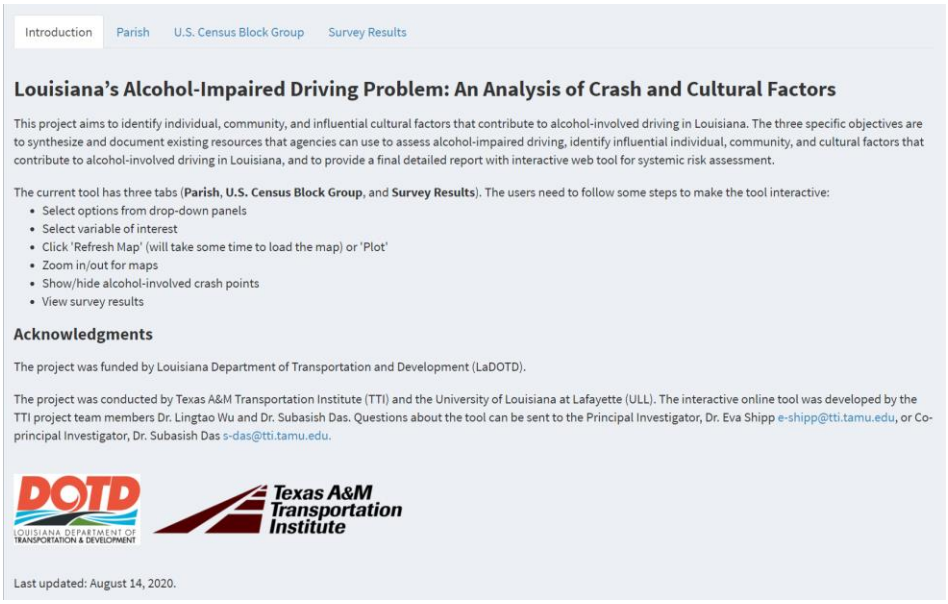


Figure 1. Interface of the interactive tool opening page

The tool interface has four different tabs:

- Introduction (the interface shown in Figure 1)
- Parish
- U.S. Census Block Group
- Survey Results

Visualization

This section describes the basic steps needed to visualize the map from parish or U.S. census block group level, and survey results.

Parish

Figure 2 shows the interface of the Parish tab. This page contains two components: the parish-level map (on the left side), and drop-down selection panel (on the right side).

The parish-level map tool has the following features:

- **Variable Selection:** from drop-down panel
- **Plot:** "Refresh Map" button under the drop-down panel
- **Overlaying Alcohol-Involved Crash Points**: check box "Show Alcohol-Involved Crashes" under button "Refresh Map"
- **Zoom in/out:** plus/minus button on the map
- **Popup Information:** hovering on a parish

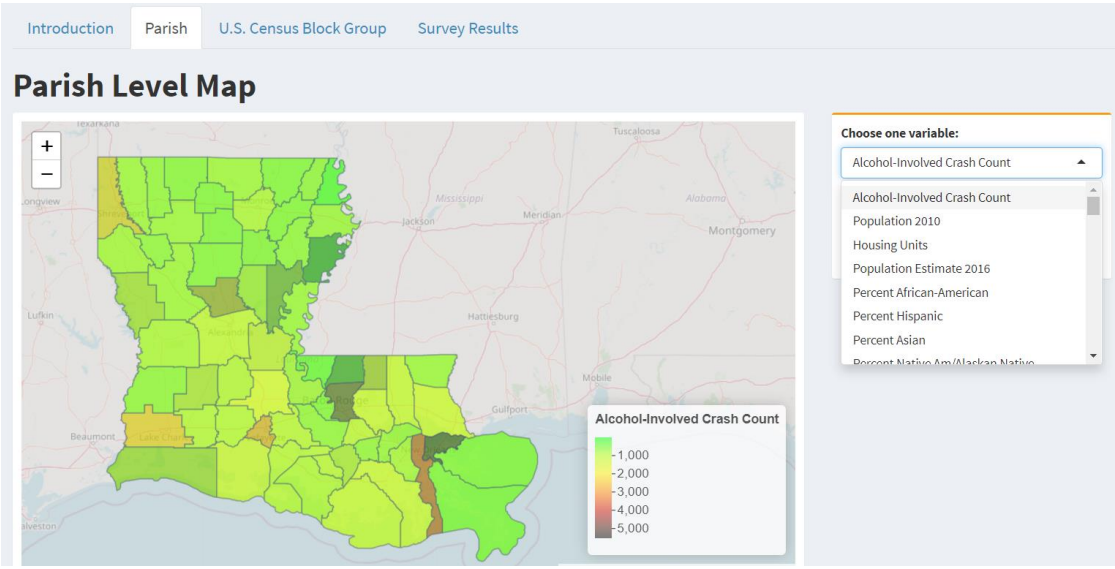


Figure 2. Parish level map tool

Steps to plot parish-level map:

- Select a variable (e.g., Alcohol-Involved Crash Count, Population 2020) from the drop-down panel
- Click “Refresh Map”
- Zoom in/out on map using the plus/minus button
- Check or uncheck “Show Alcohol-Involved Crashes” to show or hide alcohol-involved crash scatter points
- When the cursor is hovering on a parish, the related information of the parish will pop up on the map. An example is shown in Figure 3.

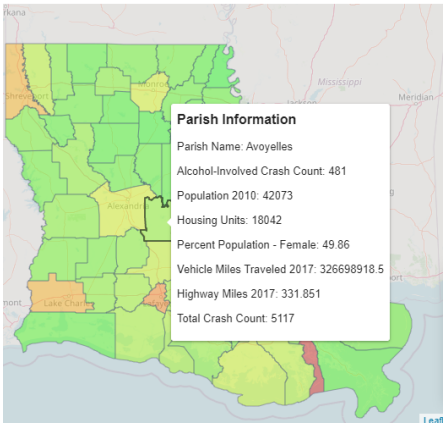


Figure 3. Example of popup information on parish-level map

U.S. Census Block Group

Figure 4 shows the interface of the U.S. Census Block Group tab. This page is quite similar to that of Parish. It contains two components: the block group-level map (on the left side), and drop-down selection panel (on the right side).

The block group-level map tool also has the following features:

- **Variable Selection:** from drop-down panel
- **Plot:** “Refresh Map” button under the drop-down panel
- **Overlaying Alcohol-Involved Crash Points**: check box “Show Alcohol-Involved Crashes” under button “Refresh Map”
- **Zoom in/out:** plus/minus button on the map
- **Popup Information:** hovering on a block group

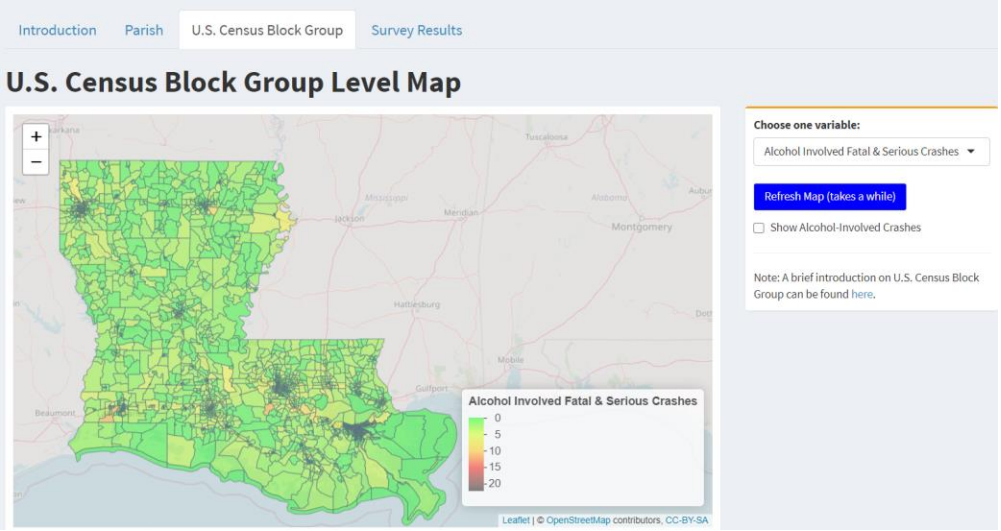


Figure 4. U.S. census block group level map tool

Steps to plot block group-level map:

- Select a variable (e.g., Alcohol-Involved Fatal and Serious Crashes, Risk Score) from the drop-down panel
- Click "Refresh Map"
- Zoom in/out on map using the plus/minus button
- Check or uncheck "Show Alcohol-Involved Crashes" to show or hide alcohol-involved crash scatter points
- When the cursor is hovering on a block group, the related information of the block group will pop up on the map.

Survey Results

Figure 4 shows the interface of the Survey Results tab. This page contains three components: the survey result plot (on the top left), drop-down selection panel (on the top right), and survey result in table format (on the bottom).

The survey results tool has the following features:

- **Variable Selection:** from drop-down panel
- **Cross Plot by Gender:** check the box "Cross Plot by Gender" above button "Plot"
- **Plot:** "Plot" button under the drop-down panel
- **Download Plot:** "Download Plot" button under the drop-down panel (right side of "Plot")
- **Download Table:** "Download Table" button under the drop-down panel (right side of "Download Plot")

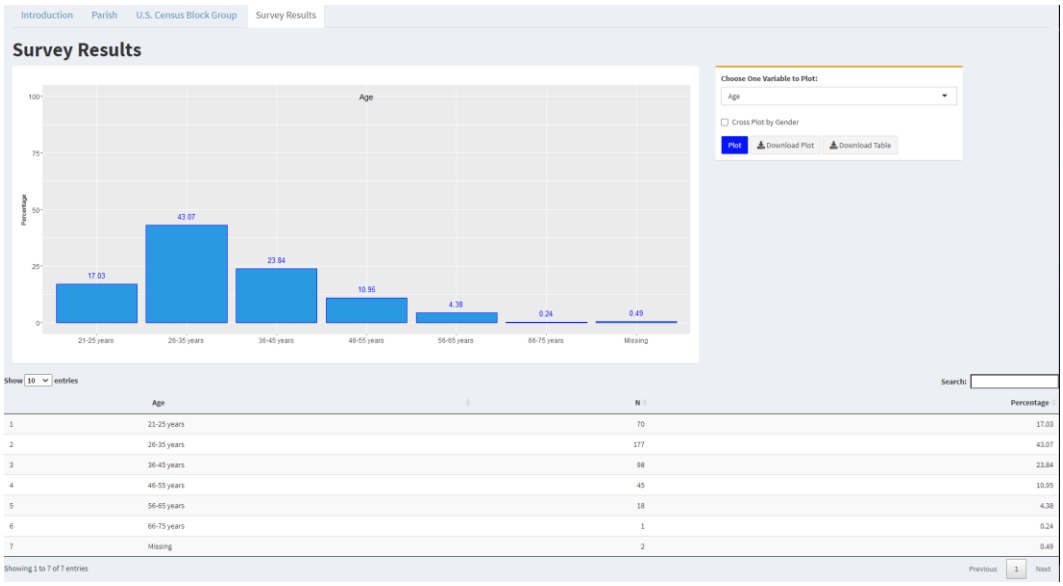


Figure 5. Survey results

Steps to plot survey results:

- Select a variable (e.g., Age, Gender, Age by Gender) from the drop-down panel
- Click “Plot”
- To cross plot the selected variable by gender, check the box “Cross Plot by Gender,” then click “Plot” (Note that Cross Plot Gender by Gender is not available.)
- The table below the plot also shows the survey results for the selected variable
- To download the plot as a PNG file, click “Download Plot”
- To download the table as a csv file, click “Download Table”

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