Rideshare Volume and DUI Incidents in Boston, Worcester, and Northampton, Massachusetts

Developed for National District Attorneys Association (NDAA)
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Executive Summary

Ridesharing offers a promising opportunity to address the continuing harm of impaired driving in the United States. This study investigated the relationship between Lyft and Uber rideshare volume and DUI incidents and arrests in three locations in Massachusetts: Boston, Worcester, and Northampton. Across all three locations, there was a substantial decrease in DUI incidents or arrests following the broad introduction of ridesharing (either by Lyft, Uber, or both) into those communities. The post-introduction decreases in incidents and arrests ranged from 39.4 percent in Northampton to 52.9 percent in Worcester. While future research is needed, these results provide a strong indication of the potential for ridesharing to address impaired driving in local communities.

Introduction

Every day, approximately 32 people in the United States die in impaired-driving crashes — that's one person every 45 minutes. According to the National Highway Traffic Safety Administration (NHTSA), in 2020, 11,654 people died in alcohol-impaired driving traffic deaths — a 14 percent increase from 2019 (10,196 to 11,654 fatalities) compared to 6.8-percent increase in overall fatalities between 2019 and 2020 (NSCA, 2022). Alcohol-impaired-driving fatalities in the past 10 years increased from 9,865 in 2011 to 11,654 in 2020. The national rate of alcohol-impaired-driving fatalities in motor vehicle crashes in 2020 was 0.40 per 100 million vehicle miles traveled (VMT), up from 0.31 in 2019. The alcohol-impaired driving fatality rate in the past 10 years has increased by 21 percent, from 0.33 in 2011 to 0.40 in 2020 (NSCA, 2022). Alcohol-Impaired-driving also carries a significant price tag in addition to the loss of life. The annual cost of alcohol-related crashes totals more than $44 billion (Blincoe et al., 2010).

The coronavirus disease (COVID-19) significantly impacted traffic safety creating several challenges for traffic safety professionals. Research has shown that although a decline in vehicle miles traveled (VMT) occurred, there was a rise in crashes as risky driving behaviors were found to have increased during this time; in particular, driving impaired, non-belt use, and speeding (Wagner et al., 2020). Research has also shown that the COVID-19 pandemic has been associated with mental health challenges related to the morbidity and mortality caused by the disease and to mitigation activities. In a survey conducted to identify this association, 13.3 percent of respondents reported having started or increased substance use to cope with stress or emotions related to COVID-19 (Czeisler et al., 2020).

Every state in the U.S. has enacted both alcohol-impaired driving and drug-impaired driving laws. Alcohol-impaired driving laws across the U.S. prohibit driving with a blood alcohol content (BAC) at or above a .08. The 2017 Utah Legislature passed HB155 “Driving Under the Influence

and Public Safety Revisions" that took effect on December 30, 2018, which made their illegal limit .05. Additionally, zero tolerance laws (e.g., for drivers under the age of 21) have been established where any measurable amount of alcohol detected when driving is illegal. Even though alcohol-impaired driving laws have been in place for several years and are well known, alcohol-impaired drivers continue to get behind the wheel and alcohol-impaired driving persists as a significant public health and safety issue on U.S. roadways.

Drug-impaired Driving laws often identified as driving under the influence of drugs (DUID) vary widely across the country. Twenty-one states AK, AZ, CA, CO, CT, IL, ME, MD, MA, MI, MO, MT, NV, NJ, NM, NY, RI, OR, VT, VA, WA, Washington D.C., Guam, and Northern Mariana Islands have passed recreational cannabis use laws. Thirty-seven states, Washington, D.C., Guam, Puerto Rico, and the U.S. Virgin Islands have passed medical marijuana/Cannabis laws. Sixteen states (AZ, DE, GA, IA, IL, IN, KY, MI, MN, NC, PA, RI, SD, UT and WI) have established Zero Tolerance laws for some drugs where driving with any measurable amount of specified drugs in the body is considered illegal. Five States (IL, OH, MT, NV, VA and WA) have implemented per se laws for drug-impaired driving where the limit is greater than zero drive with amounts of specified drugs in the body (NCSL, 2022). The Colorado legislature amended the impaired driving statute (C.R.S. 42-4-1301 (6)(a)(IV)) in 2013 to create a section addressing driving under the influence of cannabis. Colorado has implemented a permissible inference law with a limit of 5ng of Delta-9 THC (Rosenthal et al., 2020).

A recent study by the National Transportation Safety Board (NTSB) found that multiple drugs and drug categories are associated with impaired performance and increased crash risk (NTSB, 2023). While the impact of the legalization of cannabis in several states on impaired driving fatalities and serious injuries is not well established, recent studies have shown an increase in impaired driving, specifically polysubstance use while driving and an increase in impaired driving fatalities. The national roadside survey has shown an increase in drug-positive driving, including cannabis (Berning, Compton, & Wochinger, 2015). In Colorado, the number of fatalities in crashes in which drivers tested positive for THC rose from 18 in 2013 to 77 in 2016 (Rosenthal et al., 2020). In Washington State, for the first time in 2012, polydrug drivers (i.e., drivers with multiple drugs in their system) became the most prevalent type of impaired drivers involved in fatal crashes, and since then, the number of polydrug drivers involved in fatal crashes increased an average of 15 percent every year. In addition, by 2016, the number of polydrug drivers were more than double the number of alcohol-only drivers and five times higher than the number of THC-only drivers involved in fatal crashes. According to the biological results of Washington's Roadside Survey, nearly one in five daytime drivers may be under the influence of cannabis, up from less than one in 10 drivers prior to the implementation of cannabis retail sales (Grondel et al., 2018).

Several studies have examined the relationship between rideshare companies and other alternative transportation and the incidence of impaired driving incidents with varying results. The share of Americans who say they have used ridesharing services doubled between 2015 – 15 percent; and 2018 – 36 percent (Jiang, 2019). Numerous studies observed a significant decline – up to a 35 percent reduction in at least some types of traffic fatalities following the

rollout of Uber and Lyft (MADD, 2015; Martin-Buck, 2017; Peck, 2017; Greenwood and Wattal, 2017; Dills & Mulholland, 2018 & Moll Law Group, 2020; Casanova-Powell & Smith, 2020, Casanova Powell & Smith, 2021). Other studies found evidence for either no effect (Brazil and Kirk, 2016).

A study by Morrison and colleagues showed that on-demand ridesharing service coincides with a decline in the frequency of traffic crashes and support previous research findings that reported a reduction in traffic crashes after the emergence of Uber (Morrison et al., 2018). A study by Homel suggests that the increased comfort and convenience, and the decreased cost of traveling with on-demand ridesharing services compared to riding in private vehicles can encourage people to use fewer private vehicles and alleviate traffic crashes (Homel, 2017).

Recent trauma studies have found that the introduction of ridesharing services was associated with fewer impaired driving incidences and crashes resulting in injuries. A study by Freidman et al., reviewed medical records at a Level I trauma center in New Orleans, Louisiana from 2012 to 2018 and found a significant decrease in the annual average proportion of alcohol-related motor vehicle crashes pre/post the availability of ride-sharing services (39 percent vs. 29 percent). This study also showed a decrease in the average annual incidence of fatal alcohol related motor vehicle crashes and the number of DWIs in the area (Freidman et al., 2020). Another more recent study conducted by (Conner et al., 2021) collected rideshare data from Uber and Google including motor vehicle crash (MVC) traumas and convictions for impaired driving in Houston, Texas and concluded that the introduction of Uber in the Houston metropolitan area was associated with significant reductions in MVC traumas and impaired driving convictions.

Research focused on specific targeted strategies utilizing ridesharing options found similar reductions. A study by Kurtz et al., found there is potential for on-demand ride hailing alternative transportation to reduce DUI behaviors and arrests among high-risk younger populations (Kurtz, et al., 2020). A study conducted by Kirk et al. investigated differences in the timing of the deployment of Uber across Britain to test the association between the advent of Uber's ridesharing services and rates of fatal and non-fatal road crashes. This study found that the deployment of Uber in Great Britain was associated with a marginally significant reduction in the number of serious road crash injuries (Kirk et al., 2020).

A meta-analysis study by Fell et al., found that the most successful alternative transportation programs typically have the following criteria (Fell et al., 2020):

- social acceptance,
- a high level of public awareness,
- low cost,
- year-round availability,
- provide rides to and from drinking venues,
- several sponsors that provide funding,
- convenience,
- perceived to be safe.

A July 2021 study conducted by the National Bureau of Economic Research showed that the introduction of Uber decreased alcohol-related traffic fatalities in the U.S. by 6.1 percent and overall traffic fatalities by 4.0 percent (Anderson et al., 2021). This study also found that ridesharing can yield annual life-saving benefits between $2.3 to $5.4 billion. Further research is needed to document and demonstrate the effectiveness of rideshare applications. However, application of the techniques and criteria found in these recent studies regarding strategies to implement ridesharing serves as a useful countermeasure to reduce the incidence of impaired driving.

Background & Scope of Work

The National District Attorneys Association (NDAA) selected Casanova Powell Consulting and Dr. Ryan C. Smith to examine the relationship between rideshare volume and driving under the influence (DUI) incidents in three Massachusetts cities: Boston, Worcester, and Northampton in support of their existing partnership with Lyft. Lyft and Uber each contributed targeted rideshare data from these three cities to the NDAA to independently explore this relationship.[1] This novel study is among the first study to analyze rideshare data from both Lyft and Uber. Examining multiple ridesharing entities provides a more complete picture of the ridesharing climate in a community and allows for significantly greater accuracy in assessing the potential impact of these services on impaired driving.

Founded in 1950, the National District Attorneys Association (NDAA) is a national, non-partisan non-profit membership association that provides training, technical assistance, and services to prosecutors around the country in support of the prosecution profession. As the oldest and largest association of prosecutors in the country with over 5,500 members, its mission is to be the voice of America's prosecutors and to support their efforts to protect the rights and safety of the people by providing its members with the knowledge, skills, and support they need to ensure justice is attained. NDAA, located in Arlington, VA represents state and local prosecutors' offices from both urban and rural districts, as well as large and small jurisdictions. NDAA serves as a nationwide, interdisciplinary resource center for research, training, knowledge building and accountability as it works to promote a fair and equitable administration of justice (NDAA, 2023).

Lyft

Lyft is a transportation network company (TNC) that facilitates rides between riders and drivers. Lyft was founded in 2012 by Logan Green and John Zimmer to improve people's lives with the world's best transportation and is available to 95 percent of the United States population as well as select cities in Canada. Lyft is committed to effecting positive change for our cities and making cities more livable for everyone through initiatives that bridge transportation gaps, and by promoting transportation equity through shared rides, bikeshare systems, electric scooters, and public transit partnerships (GHSA, 2020).

[1] Casanova Powell Consulting and Dr. Ryan C. Smith had independent access to these data, and neither Lyft nor Uber had access to any data from the other company at any time.

Uber

Uber's mission is to create opportunity through movement. Uber started in 2010 "to solve a simple problem: how do you get access to a ride at the touch of a button? More than 37 billion trips later, Uber is building products to get people closer to where they want to be. By changing how people, food, and things move through cities, Uber is a platform that opens up the world to new possibilities".

Objectives

This study has three main objectives:

1. Obtain and format traffic safety data related to Lyft and Uber rideshare volume and DUI incidents in target locations in Massachusetts (Boston, Worcester, and Northampton).
2. Determine the relationship between Lyft and Uber rideshare volume and DUI incidents and arrests in these locations.
3. Evaluate changes in DUI trends pre- and post-Lyft and Uber introduction in these locations.

Analysis Cities

Three Massachusetts cities were selected for analysis for this report: Boston, Worcester, and Northampton. These cities were selected based on their volume of traffic, DUI incidences, and availability of data.

Between 2009 and 2018, 1,243 people were killed in crashes involving an alcohol-impaired driver in the State of Massachusetts (CDC, 2020). In 2020, Massachusetts reported 343 total traffic fatalities. Thirty-four percent (115) had tested positive for alcohol at the time of the crash, twenty-nine percent (98) had a BAC between (.08 and .149 g/dL) and nineteen percent (67) had a BAC of .15g/dL or more at the time of the crash. These numbers are either at or above the U.S. average percentages (NCSA, 2022).

Massachusetts Impaired Driving Laws

Impaired driving laws vary substantially by state. A brief description of the impaired driving laws for Massachusetts are included below to provide context to Massachusetts impaired driving legal environment.

Drug and Alcohol-Impaired Driving Laws

In Massachusetts, a DUI or DWI is called an OUI, or "Operating Under the "Influence". There are no specific laws related to Cannabis or other drugs. It is illegal to drive with a BAC at or above 0.08 percent, under 21 with a BAC of .02 or higher and commercial vehicle drivers with a BAC of .04 or higher. Under Massachusetts law, school bus drivers are commercial drivers. Enhanced penalties are imposed for those convicted of a high BAC (.20). Publicized sobriety checkpoints are allowed. Ignition interlocks are required for convicted repeat offenders. Enhanced penalties are imposed for bodily harm/injury or child endangerment offenders.

The following penalties are imposed dependent upon alcohol BAC and level of offense:

- First-time offenders face imprisonment for up to two and one-half years, a fine of $500 to $5,000, or both. The driver's license suspension period is 45 to 90 days.
- A person who commits a second offense faces imprisonment for 60 days to two and one-half years and a fine of $600 to $10,000. The driver's license revocation period is two years. After one year, the offender may apply for a reinstatement due to hardship. If granted, the offender will be required to use an ignition interlock device for the duration of the hardship license.
- A person who commits a third offense faces imprisonment for 180 days to two and one-half years and a fine of $1,000 to $15,000, or imprisonment in a state prison for two and one-half to five years and a fine of $1,000 to $15,000. The driver's license revocation period is eight years. After two years, the offender may apply for a reinstatement due to hardship. If granted, the offender will be required to use an ignition interlock device for the duration of the hardship license.
- A person who commits a fourth offense faces imprisonment for two years to two and one-half years and a fine of $1,500 to $25,000, or imprisonment in a state prison for two and one-half to five years and a fine of $1,500 to $25,000. The driver's license suspension period is 10 years. After five years, the offender may apply for a reinstatement due to hardship. If granted, the offender will be required to use an ignition interlock device for the duration of the hardship license.
- A person who commits a fifth or subsequent offense faces imprisonment for at least two and one-half years or a fine of $2,000 to $50,000 and imprisonment in a state prison for two and one-half years to five years. The offender's driver's license will be revoked for life.
- Massachusetts counts all OUI within the driver's lifetime when calculating prior offenses.

Melanie's Law, passed in 2005, has specific enhanced penalties:

- Underage drivers (defined as those under 21) will receive more stringent license suspensions if convicted of an OUI.
- Refusal of a breathalyzer may warrant a 10 - year license suspension in the event of serious bodily injury, and lifetime suspension if the crash caused a fatality.
- Second OUI conviction requires mandatory installation of an ignition interlock device (IID) for license reinstatement.

Legalization of Medical and Recreational Cannabis

A medical cannabis law became effective January 1, 2013. This law has no age restrictions with possession limits of no more than 60-day supply, up to 10 ounces or as determined by the cannabis control commission (IIHS, 2023).

A recreational cannabis law became effective December 15, 2016. This law has age restrictions similar to alcohol where a person under the age of 21 is not allowed to purchase, possess, or use cannabis. This law has possession limits where no more than 1 ounce can be in a persons

possession and no more than 10 ounces are allowed within the person's primary residence. Retail recreational sales were allowed starting November 20, 2018 (IIHS, 2023).

Methods

The general analytic approach was to examine changes in impaired driving outcomes with the introduction of ridesharing in three Massachusetts cities: Boston, Worcester, and Northampton. Data were publicly available on DUI incidents or arrests in each of these locations. Data were provided directly to the independent researchers by Lyft and Uber on monthly Lyft and Uber rideshare volume in each of those locations. At no point did Lyft or Uber have access to the other company's data nor was either company involved in the independent analysis.

Each of these locations was analyzed individually due to differences in when ridesharing was initiated in these communities and to better capture local effects of rideshare implementation and growth on DUI incidents. Initial analyses at each location focused on descriptive statistics and changes in DUI outcomes following the introduction of Lyft and Uber ridesharing in the city. Next, correlations were conducted to understand the strength of the relationship between Lyft and Uber rideshare volume and DUI outcomes. The correlations were calculated by using aggregated annual data which produces an effective measure of association between rideshare volume and DUI incidents but produces a low statistical power. Both correlation coefficients and p-values are reported but must be understood in terms of this limited power which makes finding statistical significance challenging. Finally, trends in DUI outcomes before and after the introduction of Lyft and Uber ridesharing were examined. Specifically, these analyses focused on whether trends in DUI outcomes improved in these locations following the introduction of Lyft and Uber. These pre- and post-rideshare introduction analyses were conducted by choosing the year where there was the initial "inflection point" in rideshare growth. Specifically, the first-year ridesharing was technically introduced often saw very low volumes of rideshare that would not be feasibly associated with changes in DUI outcomes. Rather, the first year where there was appreciable growth in ridesharing (either by Lyft, Uber, or combined) was chosen as the pre and post comparison point.

Under NDAA's contracts with Lyft and Uber, specific rideshare volumes could not be reported. This includes reporting out the summed total of rideshare volume across both companies. Instead, the research team created a standardized measure of rideshare volume for each location. The yearly rideshare volume of each company was combined into a single aggregate total. The average rideshare volume and standard deviation were calculated for the years where ridesharing was introduced in each community. Each annual aggregate rideshare volume was subtracted by the mean and divided by the standard deviation to create standard units. These standard units are reported for analyses.

Analyses were conducted on the earliest data available near the time of rideshare implementation by either Uber or Lyft up to 2019. Data after 2019 were excluded to minimize any data anomalies due to the COVID-19 pandemic, which was known to have a significant effect on traffic safety outcomes. This was especially true for impaired driving crashes, fatalities, and arrests.

Results

Boston

The same statistical technique (i.e., correlation) was applied to all three locations. While the trends were all similar, the magnitude of the relationship between DUIs and rideshare varied. Analyses on Boston were conducted on data from 2012 – 2019. Information on DUI incidents was collected from publicly available data in Boston starting in 2012. Ridesharing data was available as early as 2011. Approximately 18 months of ridesharing data were partially unavailable from 2013 and 2014. Data imputation was performed by creating a polynomial logistic regression model with available data from 2012 through 2019. The calculated regression model had a strong fit with the existing rideshare data ($R^2 = 0.95$). This high degree of fit, as well as what was known about rideshare volume during this time period, led the research team to feel confident using this model to impute the 18 months of data that were partially missing.

Figure 1 shows the standardized rideshare volume and reported DUI incidents from 2012 – 2019. In Boston, pre-post rideshare comparisons were used for the year 2013. This inflection point of rideshare introduction is marked in the figure by a dashed red line at that year. There was a moderate correlation between DUI incidents and rideshare volume in Boston during these years, $r = -0.48$, $p = .23$. While this was a modest correlation showing DUI incidents decreased as rideshare volume increased, it did fail to reach statistical significance – likely due to the low statistical power of the analysis. In the year before the broad increase in rideshare volume (i.e., 2012 – 2013), there was a 130.6 percent increase in DUI incidents in Boston. However, there was a 46.9 percent reduction in DUI arrests in the years following rideshare (i.e., 2013 – 2019).

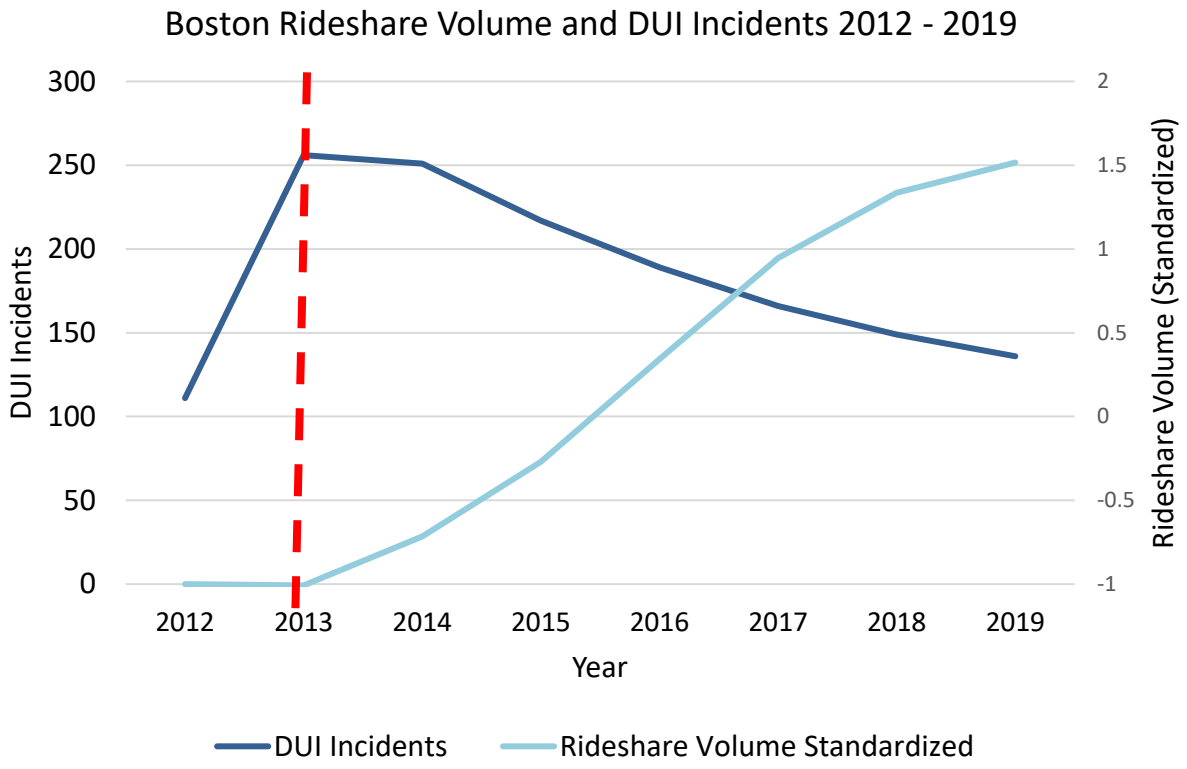

Figure 1. Boston rideshare volume and DUI incidents from 2012 - 2019.

Worcester

Data on DUI arrests were available for Worcester from 2010 – 2019. Figure 2 shows the number of DUI arrests and rideshare volume for Worcester from 2010 – 2019. The year 2014 was used as a comparison point for pre- and post-rideshare trends because it was an inflection point of rideshare growth in that community. There was a strong relationship between rideshare volume and DUI arrests, $r = -0.89$, $p < .01$. This demonstrates there was a large and statistically significant relationship where DUI arrests decreased as rideshare volume in Worcester increased. In the time period before a substantial introduction of ridesharing (i.e., 2010 – 2014) there was a 9.4 percent reduction in DUI arrests. Following the broad introduction of ridesharing (i.e., 2014 – 2019), this grew to a 52.9 percent reduction in DUI arrests.

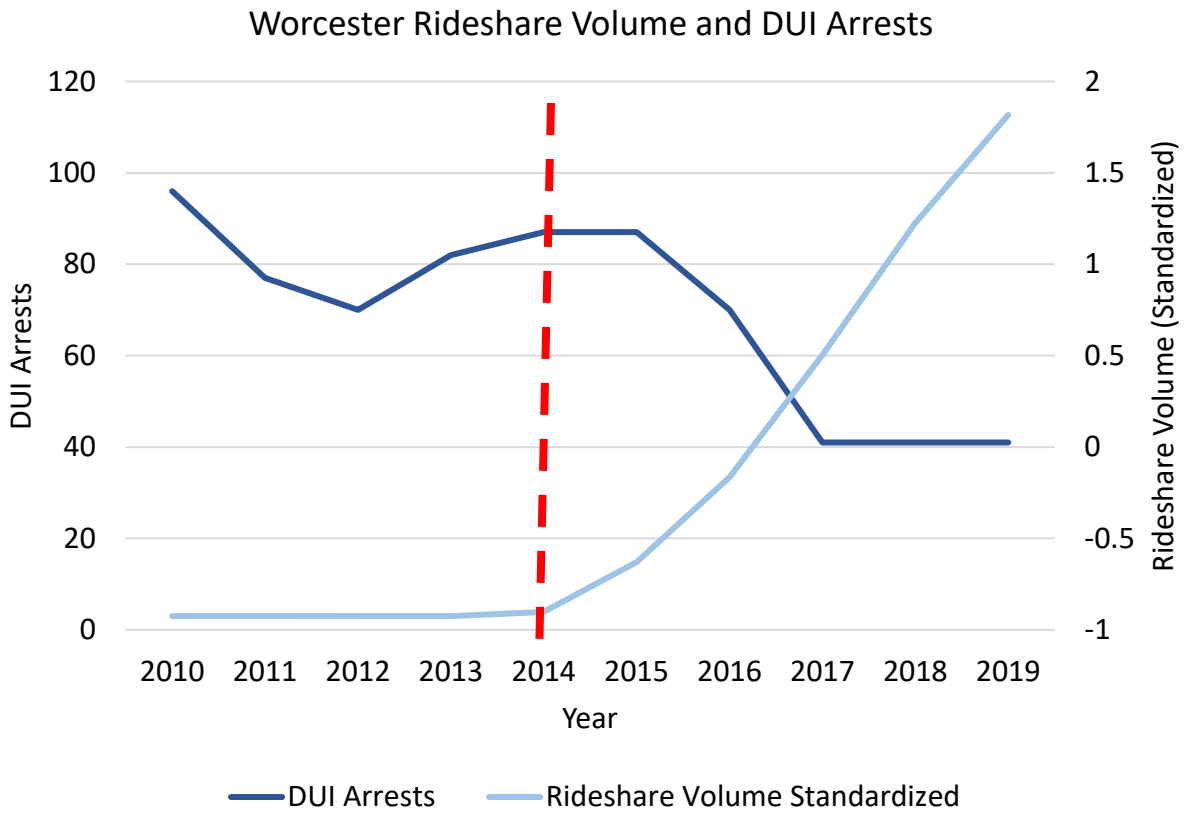

Figure 2. Worcester rideshare volume and DUI arrests 2010 - 2019.

Northampton

Impaired driving arrest data were available for Northampton from 2002 to 2019. This allowed for a longer lookback period than the other locations to observe historical trends in impaired driving arrests in this community. Figure 3 shows the relationship between DUI arrests and rideshare volume over this time. The year 2015 was chosen as a point of reference for pre-post rideshare volume comparisons because it represented an inflection point when ridesharing reached a larger market in that community. There was a modest correlation between rideshare volume and DUI arrests, r = -0.51, p = 0.46. The correlation showed that DUI arrests decreased as rideshare volume increased in Northampton. Again, this correlation did not reach statistical significance due to the low statistical power of the analysis. During the years prior to broad rideshare introduction in Northampton (i.e., 2002 – 2015), DUI arrests increased by 318.9 percent. In the years following the broad introduction of ridesharing (i.e., 2015 – 2019), DUI arrests decreased by 39.4 percent.

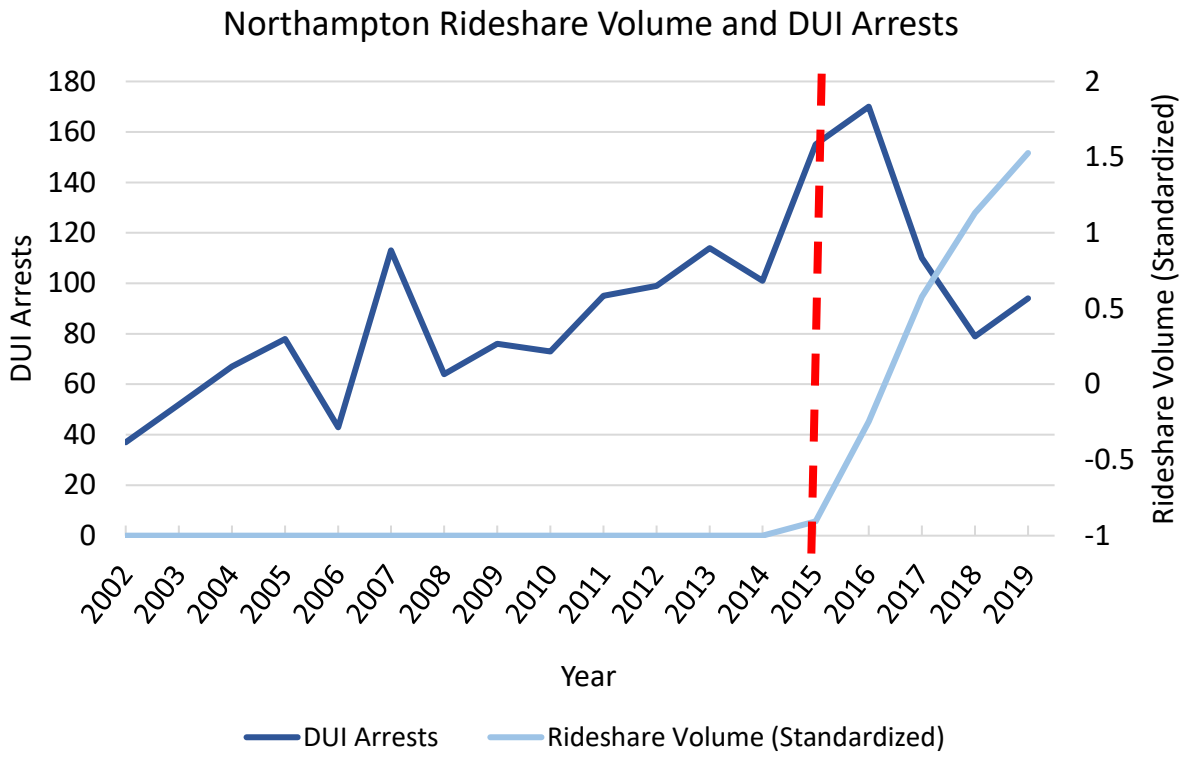

Figure 3. Northampton rideshare volume and DUI arrests 2002 - 2019.

Overall Results and Summary

The differences in data available in each of the cities, as well as other key differences in each city (e.g., when Lyft and Uber were introduced), make comparisons across each of these locations challenging. However, the individual results from Boston, Worcester, and Northampton showed strong themes across all three locations. Indeed, the results were largely consistent in each of these communities.

Across all three locations, there was a substantial decrease in DUI incidents or arrests following the broad introduction of ridesharing (either by Lyft, Uber, or both) into those communities. The post-introduction decrease in incidents and arrests ranged from 39.4 percent in Northampton to 52.9 percent in Worcester. This represents a consistent and substantial decrease in DUI incidents or arrests following the introduction of ridesharing. In both Boston and Northampton, impaired driving incidents or arrests were increasing prior to the introduction of ridesharing. In Worcester, where there was a trend towards a decrease in DUI arrests as ridesharing was being introduced, this decrease increased from 9.4 percent to 52.9 percent

In addition to expecting decreases in DUI incidents and arrests following the introduction of ridesharing, it would be expected that increases in rideshare volume would result in larger decreases in impaired driving arrests. This was examined in the present research by calculating the correlation between rideshare volume and DUI incidents or arrests. There was a consistent moderate to strong negative correlation between these two variables. Specifically, this means

that as rideshare volume increased, there was a similar decrease in DUI incidents or arrests. Largely due to the low statistical power of the analysis (i.e., each year being aggregated into a single data point), not all these correlations were statistically significant despite the relatively large magnitude of the correlations. However, it is notable that this correlation did reach statistical significance for Worcester.

Discussion

Importance of Rideshare

NHTSA has reported that night and weekend alcohol-impaired driving fatalities are consistently higher than other days and times of the week (NCSA, 2019). Rideshare, which is largely during these proven higher fatality periods, should be seriously considered when seeking mitigation efforts.

With the recent increase in risky driving trends due to the COVID pandemic and the persistence of these behaviors, including driver impairment by alcohol and other drugs, we have lost important life-saving ground in our efforts to get to zero deaths on our roadways. As of Feb. 3, 2022, 37 states, three territories and the District of Columbia allow the medical use of cannabis products. Twenty-one states, two territories, and the District of Columbia have legalized small amounts of cannabis for adult recreational use, and several remaining states are moving to legalize and decriminalize recreational and medical cannabis. As previously mentioned, mental health challenges related to COVID-19–associated morbidity, mortality, and mitigation activities are on the rise. These elevated levels of adverse mental health conditions, substance use, and suicidal ideation reported by adults likely continues to contribute to the increase in drinking and driving behaviors. Changes in policy, paired with the increased use of prescription and over-the-counter drugs, highlights the increased public safety threat of driving under the influence of alcohol and other drugs on U.S roadways. Recommendations regarding alcohol- and other drugimpaired driving have been on the NTSB most wanted list since its inception in 1990. A recently released NTSB report provides the latest examples of safety recommendations to combat alcohol- and other drug-impaired driving (NTSB, 2022).

As previously stated, rideshare services, more now than ever, offer an affordable, convenient, and accessible alternative. An annual economic survey conducted by Lyft found that 71 percent of riders reported they are less likely to drive substance-impaired due to the availability of Lyft. A study conducted by Uber in 2018 found in the first 6 months of Uber's operation in Salem, Oregon, over 59% of Uber's late-night weekend trips started near an alcohol-serving business (Williams and Anderson, 2018). As rideshare becomes more prominent, riders respond in a positive way. Lyft's 2023 Economic Report repoorts that 60 percent of riders use Lyft to find a rideshare driver when they are planning to drink alcohol or use another substance that could impair driving ability (Lyft, 2023)

Most alcohol impaired driving fatalities occur on nights and weekends, this information aligns with the frequency of Lyft's reported ride use where the majority of Lyft rides take place outside of commute hours, such as nights and weekends. In addition, according to a recent analysis by Lyft, more Lyft pick-ups and drop-offs occur in areas where entertainment and nightlife

establishments occur and during the evening (Hutchinson, 2020). Previously mentioned research by Kurtz and Buttram (2021) showed that pairing marketing and messaging to utilize ridesharing alternatives to these demographics can reduce the incidence of impaired driving.

Limitations

Limitations of this study and approach should be acknowledged. The purpose of this study was to examine the correlational relationship between impaired driving incidents and the presence of Lyft and Uber in these cities. This study is not intended to identify a causal relationship between the use of Lyft or Uber's rideshare services and the frequency of impaired driving outcomes. As with the prior two Casanova Powell & Smith studies, due to the lack of true experimental control and the large number of variables that impact traffic outcomes, a causal attribution cannot be given to ridesharing in directly producing the improvements in DUI outcomes that were observed across all three study cities. However, the results are consistent with research hypotheses that ridesharing would be associated with traffic safety improvements. The results provide early support for the safety benefits of ridesharing and should encourage further research in this area.

There are several factors that were not examined for the purposes of this study that can influence the number of impaired driving incidents. Some of these factors include vehicle miles traveled (VMTs), law enforcement engagement, countermeasures and messaging that may have been conducted during these times, socioeconomic influences, sex, age, and other demographics.

Data were only provided for Boston, Worchester, and Northampton, Massachusetts. Control cities were not used for pre-post comparison purposes. Data obtained for this study could only be analyzed at the aggregate level since it is not possible to solely examine Lyft or Uber's relationship with traffic outcomes at the individual level.

Despite these limitations, this and the previous study provide additional information to the limited empirical knowledge about the association of rideshare services with traffic outcomes. Future research should investigate these relationships to further expand our understanding of rideshare services.

Recommendations

Several studies have shown that rideshare platforms are related to reductions in impaired driving arrests, fatalities, and crashes, while other studies show no effect. This study adds to that body of literature and is a crucial early step in understanding the potential value of ridesharing in reducing DUI harm. Although reductions in DUI incidents were observed with the introduction of Lyft and Uber in all three cities, the correlational results cannot be used to determine a causal relationship. It is possible and likely that other factors may have influenced these reductions. It is recommended that further research is conducted using additional data which, at a minimum, includes vehicle miles traveled, law enforcement engagement, and economic factors.

The research team applauds the Lyft and Uber's dedication to improving public safety and providing targeted rideshare data to the research team in an effort to promote and support this

research and recommends further collaborative efforts to investigate the potential for these trends in other cities across the U.S and other countries. Additionally, the research team encourages all rideshare programs to engage in similar data sharing to allow for greater understanding of rideshare benefits and to conduct more robust studies to identify the impact of rideshare platforms on impaired driving incidents.

References

Anderson, M.L. and L.W. Davis (July, 2021) Uber and Alcohol-Related Traffic Fatalities NBER Working Paper No. 29071 JEL No. I12,I18,R41,R49 https://www.nber.org/system/files/working_papers/w29071/w29071.pdf

Baktari, J. (2019, December) Worst States for DUIs. Accessed: 3-20-21. Retrieved from: https://www.usdrugtestcenters.com/research-articles/14/worst-states-for-duis.html
Barrios, J.M., Hochberg, Y. V. & Yi, H. The Cost of Convenience: Ridesharing and Traffic Fatalities (March 17, 2019). Chicago Booth Research Paper No. 27, Available at SSRN: https://ssrn.com/abstract=3259965 or http://dx.doi.org/10.2139/ssrn.3259965

Beitel, G. A., Sharp, M. C., & Glauz, W. D. (2000). Probability of arrest while driving under the influence of alcohol. Injury prevention : journal of the International Society for Child and Adolescent Injury Prevention, 6(2), 158–161. https://doi.org/10.1136/ip.6.2.158

Bergen, G., Shults, R., & Rudd, R.A. (2011). Vital signs: alcohol-impaired driving among adults--United States, 2010. MMWR. Morbidity and mortality weekly report, 60 39, 1351-6 . https://pubmed.ncbi.nlm.nih.gov/21976118/

Berning, A., Compton, R., & Wochinger, K. (2015, February). Results of the 2013-2014 National Roadside Survey of alcohol and drug use by drivers. (Traffic Safety Facts Research Note. Report No. DOT HS 812 118). Washington, DC: National Highway Traffic Safety Administration. https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/812118-roadside_survey_2014.pdf

Blincoe LJ, Miller TR, Zaloshnja E, Lawrence BA. National Highway Traffic Safety Administration. The economic and societal impact of motor vehicle crashes, 2010. (Revised). U.S. Department of Transportation, Washington, DC; 2015. Available at: http://www-nrd.nhtsa.dot.gov/pubs/812013.pdf

Brazil, N. & Kirk, D.S., Uber and Metropolitan Traffic Fatalities in the United States, *American Journal of Epidemiology*, Volume 184, Issue 3, 1 August 2016, Pages 192–198, https://doi.org/10.1093/aje/kww062

Casanova Powell, T.D. & R. Smith (2020) Rideshare Volume and DUI Incidents in Three California Cities. Developed for National Association of District Attorneys (NDAA). http://ndaa.org/wp-content/uploads/NDAA_Lyft_FinalReport.pdf

Casanova Powell, T.D. & R. Smith (2020) Rideshare Volume and DUI Incidents in Atlanta, Georgia; Chicago, Illinois; and Fort Worth, Texas. Developed for National Association of District Attorneys (NDAA). https://ndaa.org/wp-content/uploads/NDAA-Lyft-Report-Atlanta-et-al.pdf

Center for Disease Control and Prevention (2020, July) Sobering Facts: Alcohol-Impaired Driving Massachusetts. Accessed 2-14-23. Retrieved from: https://www.cdc.gov/motorvehiclesafety/pdf/impaired-driving-new/CDC-impaired-driving-fact-sheet-Massachusetts.pdf

Conner CR, Ray HM, McCormack RM, Dickey JS, Parker SL, Zhang X, Vera RM, Harvin JA, Kitagawa RS. Association of Rideshare Use With Alcohol-Associated Motor Vehicle Crash Trauma. JAMA Surg. 2021 Aug 1;156(8):731-738. doi: 10.1001/jamasurg.2021.2227. PMID: 34106241; PMCID: PMC8190695.

Czeisler MÉ , Lane RI, Petrosky E, et al. Mental Health, Substance Use, and Suicidal Ideation During the COVID-19 Pandemic — United States, June 24–30, 2020. MMWR Morb Mortal Wkly Rep 2020;69:1049–1057. DOI: http://dx.doi.org/10.15585/mmwr.mm6932a1

Dixon, G. (2021) Texans spent much of 2020 stuck at home. So why did so many people die in car crashes? March 19, 2021. Accessed 3-21-2021. Retrieved from: https://www.star-telegram.com/article249945714.html

Dills, A. & Mulholland, S. (2018). Ridesharing, Fatal Crashes, and Crime. Southern Economic Journal. 84. 10.1002/soej.12255. DOI: 10.1002/soej.12255

Fell, J., Scolese, J., Achoki, T., Burks, C., Goldberg, A., and DeJong, W. (2020) The effectiveness of alternative transportation programs in reducing impaired driving: A literature review and synthesis. *Journal of Safety Research*. Online access. Accessed 9-21-20. https://doi.org/10.1016/j.jsr.2020.09.001

Friedman, Jessica MD; Hendrix, Vera MD; Fustok, Judy JD; Reza, Tara MPH; Madda, Prathima; Smith, Alison MD, PhD; Mayer, Scott MD; Duchesne, Juan MD; Greiffenstein, Patrick MD; Schroll, Rebecca MD Correlation of ride sharing service availability and decreased alcohol-related motor vehicle collision incidence and fatality, Journal of Trauma and Acute Care Surgery: September 2020 - Volume 89 - Issue 3 - p 441-447
doi: 10.1097/TA.0000000000002802.
https://journals.lww.com/jtrauma/Abstract/2020/09000/Correlation_of_ride_sharing_service_availability.4.aspx

Governors Highway Safety Association (GHSA) Lyft. Accessed 3-22-21. Retrieved from: https://www.ghsa.org/members/lyft

Governors Highway Safety Association (GHSA) (2020, November) Lyft and GHSA Award Grants to Help States Offer Motorists an Alternative to Driving Impaired During the Holidays. Accessed 3-20-21. Retrieved from: https://www.ghsa.org/resources/news-releases/Lyft-Grants20

Governors Highway Safety Association (GHSA) (2020, September) Lyft and GHSA Partner with States to Deter Impaired Driving During the Holidays. Accessed 9-23-20. Retrieved from: https://www.ghsa.org/resources/news-releases/LyftGrants19

Grondel, D., Hoff, S., and Doane, D. (2018, April) Marijuana Use, Alcohol Use, and Driving in Washington State: Emerging Issues With Poly-Drug Use on Washington Roadways. Accessed 2-15-23. Retrieved from: https://wtsc.wa.gov/wp-content/uploads/2018/04/Marijuana-and-Alcohol-Involvement-in-Fatal-Crashes-in-WA_FINAL.pdf

Homel R. 2017. Drivers who drink and rational choice: Random breath testing and the process of deterrence. In: Routine activity and rational choice. New York: Routledge. p. 59–84. https://www.ojp.gov/ncjrs/virtual-library/abstracts/drivers-who-drink-and-rational-choice-random-breath-testing-and

Hutchinson, E. (2020). There's no excuse for driving impaired. Apr 24, 2019. Accessed 9-20-20 https://medium.com/sharing-the-ride-with-lyft/theres-no-excuse-for-driving-impaired-38c37ce29c92.

Insurance Institute for Highway Safety (2023, February) Marijuana Laws By State. Accessed 2-14-23. Retrieved from: https://www.iihs.org/topics/alcohol-and-drugs/marijuana-laws-table

Jiang J. More American are using ridesharing apps (2019). Available from: https://www.pewresearch.org/fact-tank/2019/01/04/more-americans-are-using-ridesharing -apps/. Accessed 10 March 2021

Kirk, David & Cavalli, Nicolo & Brazil, Noli. (2020). The implications of ridehailing for risky driving and road accident injuries and fatalities. Social Science & Medicine. 250. 112793. 10.1016/j.socscimed.2020.112793. https://www.researchgate.net/publication/338529950_The_implications_of_ridehailing_for_risky_driving_and_road_accident_injuries_and_fatalities

Kurtz, S.P. and M. E. Buttram (2021) Ride hailing app use and drunk/drugged driving among young adult nightclub patrons, Traffic Injury Prevention, 22:1, 20-25, DOI: 10.1080/15389588.2020.1839060 https://doi.org/10.1080/15389588.2020.1839060

Lyft (2023) Lyft Economic Report. Accessed 7-24-23. Retrieved from: https://drive.google.com/file/d/1f65ajzda0pp5csSHGYet2uaMr2Kfm3E9/view

Martin-Buck F. Driving safety: an empirical analysis of ridesharing's impact on drunk driving and alcohol-related crime, 2016. Retrieved from: http://www.frankmartinbuck.com/Ridesharingpercent20andpercent20Alcohol-Relatedpercent20Crimepercent20bypercent20Frankpercent20Martin-Buck.pdf (accessed 22 Sept 2020).

Mass.gov Massachusetts General Laws c.90 § 24: https://www.mass.gov/info-details/mass-general-laws-c90-ss-24

Massachusetts Legislature - AN ACT INCREASING PENALTIES FOR DRUNK DRIVERS IN THE COMMONWEALTH (Melanie's Law): https://malegislature.gov/Laws/SessionLaws/Acts/2005/Chapter122

Moll Law Group (2020, September). Ridesharing Impact on Drunk Driving. Accessed 9-22-20. Retrieved from: https://www.molllawgroup.com/ridesharing-impact-on-drunk-driving.html

Morrison, C. N., Jacoby, S. F., Dong, B., Delgado, M. K., & Wiebe, D. J. (2018). Rideshare and Motor Vehicle Crashes in 4 US Cities: An Interrupted Time-Series Analysis. American journal of epidemiology, 187(2), 224–232. https://doi.org/10.1093/aje/kwx233

National Center for Statistics and Analysis. (2022, April). Alcohol-impaired driving: 2020 data (Traffic Safety Facts. Report No. DOT HS 813 294). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813294

National Center for Statistics and Analysis. (2020, December). Overview of motor vehicle crashes in 2019. (Traffic Safety Facts Research Note. Report No. DOT HS 813 060). National

Highway Traffic Safety Administration.
https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813060

National Center for Statistics and Analysis. (2020, October). Early estimate of motor vehicle traffic fatalities for the first half (Jan–Jun) of 2020 (CrashStats Brief Statistical Summary. Report No. DOT HS 813 004). National Highway Traffic Safety Administration. Available at https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813004

National Center for Statistics and Analysis. (2020, June). State Alcohol Impaired-driving estimates: 2018 data (Traffic Safety Facts. Report No. DOT HS 812 917). National Highway Traffic Safety Administration.
https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812917

National Center for Statistics and Analysis. (2020, June). Early estimate of motor vehicle traffic fatalities for the first quarter of 2020. (CrashStats Brief Statistical Summary. Report No. DOT HS 812966). National Highway Traffic Safety Administration.
https://crashstats.nhtsa.dot.gov/Api/Public/Publication/813053

National Center for Statistics and Analysis. (2019, December). Alcohol-impaired driving: 2018 data (Traffic Safety Facts. Report No. DOT HS 812 864). Washington, DC: National Highway Traffic Safety Administration.
https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812864

National Center for Statistics and Analysis. (2019, October). 2018 fatal motor vehicle crashes: Overview. (Traffic Safety Facts Research Note. Report No. DOT HS 812 826). Washington, DC: National Highway Traffic Safety Administration.
https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812826

National Council of State Legislatures (2022, November) Drugged Driving/Marijuana Impaired Driving. Accessed 2-15-23. Retrieved from: https://www.ncsl.org/transportation/drugged-driving-marijuana-impaired-driving

National District Attorney's Association (2020, September). About NDAA. Accessed 9-22-20. Retrieved from: https://ndaa.org/about/aboutndaa/

National Highway Traffic Safety Administration, Presence of Drugs in Drivers
https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13839-drugged_facts_flyer_101918_v8_002.pdf.

National Transportation Safety Board (2022, December) Alcohol, Other Drug, and Multiple Drug Use Among Drivers https://www.ntsb.gov/safety/safety-studies/Documents/SRR2202.pdf

Peck, J.L. New York City Drunk Driving After Uber. *CUNY Academic Works: Economics Working Papers, Working Paper Series.* 2017
https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=1012&context=gc_econ_wp

Rosenthal, A., & Reed, J. K. (2022). Driving Under the Influence of Drugs and Alcohol Driving Under the Influence of Drugs and Alcohol. Colorado Department of Public Safety.
https://cdpsdocs.state.co.us/ORS/Docs/Reports/2020-DUI_HB17-1315.pdf

Sarkar S., Andreas, M., de Faria F. Who uses safe ride programs: an examination of the dynamics of individuals who use a safe ride program instead of driving home while drunk. *American Journal Drug Alcohol Abuse*. 2005;31(2):305-25. PMID: 15912718. https://pubmed.ncbi.nlm.nih.gov/15912718/

Safety.com (2020, January). Does Ridesharing Reduce Drunk Driving Incidents? Accessed 9-18-20. Retrieved from: https://www.safety.com/ridesharing-reduce-drunk-driving-incidents/

Texas Penal Code https://statutes.capitol.texas.gov/Docs/PE/htm/PE.49.htm

Thomas, F. D., Berning, A., Darrah, J., Graham, L., Blomberg, R., Griggs, C., Crandall, M., Schulman, C., Kozar, R., Neavyn, M., Cunningham, K., Ehsani, J., Fell, J., Whitehill, J., Babu, K., Lai, J., and Rayner, M. (2020, October). Drug and alcohol prevalence in seriously and fatally injured road users before and during the COVID-19 public health emergency (Report No. DOT HS 813 018). National Highway Traffic Safety Administration. https://rosap.ntl.bts.gov/view/dot/50941

Uber & MADD (2015) MORE OPTIONS. SHIFTING MINDSETS. DRIVING BETTER CHOICES. Online Access. Accessed 9-20-20. Retrieved from: https://newsroom.uber.com/wp-content/uploads/2015/01/UberMADD-Report.pdf

Webb, C. N. (2020, May). Geospatial summary of crash fatalities (Report No. DOT HS 812 607). Washington, DC: National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812607

Williams and Anderson (2018) Uber Under the Hood. Online Access. Accessed 7-24-23. Retrieved from: https://medium.com/uber-under-the-hood/creating-designated-riders-a-tale-of-two-cities-c9930588ab14

Wise, J. (2021). 2021 Illinois DUI Fact Book. Secretary of State Office. https://www.cyberdriveillinois.com/publications/pdf_publications/dsd_a118.pdf