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SAFE RIDES AS AN ALTERNATIVE TO ALCOHOL-IMPAIRED DRIVING AND THEIR EFFECTS: A LITERATURE REVIEW

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Safe rides as an alternative to alcohol-impaired driving and their effects: A literature review

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EXECUTIVE SUMMARY

Introduction

In 2015, more than 32,000 persons were killed in the United States as a result of motor vehicle crashes; 10,265 of these deaths involved an alcohol-impaired driver (NHTSA 2016). One solution to help reduce alcohol-impaired driving is the use of safe ride programs. These programs provide impaired drivers with alternative transportation such as taxi services and public transportation options to get home (Sarkar et al. 2005), and include both for-profit and non-profit safe ride programs. Many for-profit safe ride programs such as Uber and Lyft are similar to city taxis yet offer a lower fare and the increased convenience of hailing a cab through a mobile application.

As a result of the increased use of both for-profit and non-profit safe rides, researchers have investigated the effect that safe ride programs have had on the number of alcohol-impaired traffic-related incidents, such as arrests, crashes, and fatalities that occur annually. Results from a variety of studies have suggested that the increased use of safe rides has led to a decrease in the number of alcohol-impaired driving vehicle crashes (Dills and Mulholland 2016; Greenwood and Wattal 2015; Huseth 2012). These findings have led some researchers to conclude that safe rides are an effective method of decreasing impaired driving arrests, crashes, and fatalities.

Methodology

The studies included in this literature review were identified through a systematic search of online catalogues of relevant libraries. Approximately 40 articles and studies were reviewed and included in this literature review after searching the online catalogues and libraries using a variety of key terms. These key terms included impaired driving, safe rides, safe ride programs, ridesourcing, ridesharing, transportation network companies, Uber, and Lyft. After an initial search using these terms, the terms were then coupled with additional key terms, such as traffic, DUI/DWI, alcohol, and law enforcement.

Findings

The review includes findings from studies that examined the effect of safe ride programs on alcohol-impaired driving arrests, crashes, and fatalities.

When investigating the effect of both for-profit and non-profit safe ride programs on alcohol-impaired driving arrests, seven studies suggested a relationship between safe rides and a resulting reduction in impaired driving arrests. Using data from the Federal Bureau of Investigation Uniform Crime Reports (UCR), a 2016 study indicated that a one-time 33% decrease in impaired driving arrests occurred following the entry of Uber in various counties across the United States (Dills and Mulholland 2016). A study investigating the effect of a university safe ride program on alcohol-impaired driving arrests determined based on city police data that there was a 1.75% decrease in impaired driving arrests after the implementation of the program (Elam et al. 2006).

The decrease of alcohol-impaired driving crashes after the entry of Uber has been dubbed the "Uber Effect." To investigate the impact of the Uber Effect in California, Mothers Against Drunk Driving (MADD) conducted a study examining the number of monthly alcohol-related crashes before and after the entry of Uber in California. Results of the study indicated that an estimated 1,800 alcohol-related crashes had been prevented in California since the entry of UberX in July 2012 (MADD 2015).

Four studies examining the impact of safe ride programs on alcohol-impaired driving fatalities were included in this review. Of the four studies, three reported that safe ride programs have a causal effect leading to a reduction of alcohol-impaired driving fatalities, but the study periods were relatively short, especially the post-implementation period. In contrast, a 2016 study by Brazil and Kirk showed that Uber had little to no effect on traffic fatalities. The study examined the relationship between the deployment of Uber and subsequent alcohol-related traffic fatalities in the 100 largest metropolitan areas in the United States from 2005 to 2014 (Brazil and Kirk 2016). Three categories of traffic fatalities were considered in this study: total, impaired driving, and weekend/holiday-specific. While results indicated that counties experienced an increase in the total number of traffic fatalities during the months Uber was present, the number of weekend/holiday-specific fatalities decreased (Brazil and Kirk 2016). Researchers attributed this to the fact that Uber represents a relativity small portion of the transportation market within the United States. As such, the lack of an effect was not considered surprising by authors in light of the large number of annual alcohol-related traffic fatalities; approximately 10,000 per year (Brazil and Kirk 2016).

Conclusion

While many studies included in this review suggest that safe ride programs have a positive impact on the reduction of alcohol-impaired driving arrests, crashes, and fatalities, it cannot be explicitly concluded that safe ride programs reduce impaired driving crashes and fatalities. To date, the evidence available supports only a correlational relationship rather than a causal one. As such, the available evidence suggests safe ride programs are a promising method to decrease incidents of alcohol-impaired driving, but further exploration of these effects is necessary in order to conclude these programs are definitively effective.

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INTRODUCTION

More than 32,000 persons were killed in the in the United States in 2015 as a result of motor vehicle crashes; 10,265 of these deaths involved an alcohol-impaired driver (NHTSA 2016). Safe ride programs are one solution to help reduce alcohol-impaired driving. These programs provide impaired drivers with alternative transportation options such as taxi companies or city transportation to get home (Sarkar et al. 2005). As a result of the increase in both for-profit and non-profit safe ride options, researchers have investigated the effect that safe rides have on the number of alcohol-impaired traffic-related incidents that occur annually. Results from a handful of studies suggest the increased use of safe rides has led to a decrease in the number of vehicle crashes due to alcohol-impaired driving (Dills and Mulholland 2016; Greenwood and Wattal 2015; Huseth 2012). These findings have led some researchers to conclude that safe rides are an effective strategy to decrease impaired driving arrests, crashes, and fatalities.

In light of these recent developments, the main objective of this study is to summarize the existing literature on the effect of safe rides on impaired driving arrests, crashes, and fatalities. This literature review begins with some background information about safe ride programs and describes the two key approaches to safe rides: for-profit and non-profit safe ride programs. For-profit safe ride strategies are reviewed first and relevant legislation and regulations that apply to safe ride companies are discussed. The effects of safe rides on existing taxi companies are also described and six prominent for-profit safe ride programs that exist worldwide are briefly summarized. Non-profit safe ride strategies are similarly defined and three types of non-profit safe rides are described including: university operated, law enforcement operated, and privately owned programs. The second section of this report contains a detailed synthesis of existing research that has examined the effect of safe rides on alcohol-related traffic incidents including arrests, crashes and fatalities. Finally, the conclusion section highlights the main findings from this review and discusses strengths and gaps associated with the available literature.

METHODOLOGY

Literature that was selected for inclusion in this review was identified through a systematic search of online catalogues of relevant libraries, primarily online university libraries for the University of New Brunswick and the University of Guelph, as well as from the National Highway Traffic Safety Administration (NHTSA) and Traffic Injury Research Foundation (TIRF) libraries. The online university libraries search through many resources and journals, and provided access to studies from a wide variety of available sources, such as Scholar's Portal, EBSCOhost Academic Search Premier, and Elsevier Science Direct.

The online catalogues and TIRF library were searched using a variety of key terms including: impaired driving, safe rides, safe ride programs, ridesourcing, ridesharing, transportation network companies, Uber, and Lyft. After an initial search using these terms, the terms were then coupled with additional key terms, such as traffic, DUI/DWI, alcohol, and law enforcement.

Through the identification of sources using these terms, approximately 40 articles and studies were included in this literature review after reviewing articles to ensure they were relevant to the topic.

SAFE RIDE PROGRAMS

Safe ride programs have evolved from the concept of a "designated driver" which is defined as one person within a group who refrains from the consumption of alcohol so that they can transport passengers home safely (Logan 2014). Among a group of friends, common practice involves taking turns being the designated driver. The concept of a designated driver first surfaced in Scandinavia in the 1920s and has since become a well-known practice worldwide (Logan 2014). In recent years, research has been conducted to determine whether or not designated drivers are entirely sober or simply the most sober person in the group. Results have indicated that many designated drivers commonly drink less than they normally would during a night out, and therefore are more sober than usual, but not necessarily entirely sober (Barr and Mackinnon 1998; Caudill 2001; Rivara et al. 2007; Sarkar et al. 2005). As such, using a safe ride has become a viable alternative to using a designated driver and helps to ensure drivers have refrained from drinking. This eliminates the concern of whether or not the designated drivers are truly unimpaired (Rivera et al. 2012). The following sections provide an overview of both for-profit safe rides, also referred to as Transportation network companies, and non-profit safe rides.

Transportation network companies

This section examines for-profit safe rides. After providing a definition, the difference between ridesourcing and ridesharing is explained. This is followed by a discussion of relevant legislation and policy, and the effect of for-profit safe rides on taxi companies. An overview of six prominent for-profit safe ride companies is also included in this section

Definition

For-profit safe rides are more commonly referred to as ride-hailing, on-demand rides, and transportation network companies (TNCs). TNCs are ridesourcing companies that provide pre-arranged transportation services through a mobile application (app) (Geisser 2015; Horepedahl 2015; Kortum 2015). These apps connect passengers with drivers who use their personal vehicle to transport customers (Geisser 2015). TNCs are specifically defined in accordance with three periods of use: (1) the time in which the app is open and a driver is waiting for a request from a customer; (2) the time in which the driver has accepted a travel request and is driving to the pick-up location, and, (3) the time in which the customer is in the vehicle until the passenger is dropped off at their pre-determined location (Geisser 2015; Rayle et al. 2016). TNCs typically provide lower costs and faster service when compared with taxi companies, which helps explain

their immense success (Horepedahl 2015). While TNCs have been praised for lowering the costs of travel and stimulating job growth, a common criticism relates to the lack of responsibility and liability for any damage caused to passengers, pedestrians, and drivers and passengers of other vehicles. TNCs claim they are not responsible for the drivers, but instead are only the platform that connects drivers to customers (Geisser 2015; Posen 2015). This criticism is further explored below in relation to legislation and policy.

Ridesourcing versus ridesharing

Although similar in their name and purpose, ridesourcing and ridesharing are two different forms of travel. Ridesourcing drivers operate for profit and provide rides that they otherwise would not provide. In contrast, ridesharing drivers do not operate for profit and provide rides for people who are going to the same or nearby destination (Rayle et al. 2016). While ridesharing drivers do not charge a fee, passengers commonly share the cost of gas. In many large cities, ridesharing is encouraged through the use of car-pool, or high-occupancy vehicle (HOV) lanes, reduced tolls, and designated "park and ride" lots where drivers can leave their car and drive the remainder of the trip with others (Gidófalvi et al. 2008). While ridesourcing drivers offer transportation for profit, ridesharing drivers offer transportation for convenience (Rayle et al. 2016). Furthermore, ridesourcing drivers offer rides to any passenger within a certain radius at the time of their ride request. The GPS in the phone is used within the ridesourcing app to request a pick-up and drop-off location (Rayle et al. 2016). Although different in their procedures, both ridesourcing and ridesharing provide transportation and can mitigate congestion and parking issues (Gidófalvi et al. 2008).

Legislation and policy

TNCs have risen in popularity overnight. As a result, cities and states have been bombarded with requests, predominantly from taxi companies, to create legislation regarding the operation of these businesses. While some cities have chosen to ignore the influx of TNCs, others have implemented legislation that regulates the licensing of TNCs, in addition to drafting legislation for drivers of TNCs.

The City of Seattle was the first city in the United States to effectively address the increased operation of TNCs through the creation of legislation in 2013 entitled, "Rules for Transportation Network Companies" (Ross 2015). This legislation initially restricted the maximum number of drivers that a TNC could have operating in the city to 150, however this was later removed in response to arguments from TNCs that the cap defeated the purpose of their business model (Ross 2015). What remained were regulations that included: the company must have a valid TNC license and valid Seattle business license, all vehicles must comply with insurance standards, and records must be kept and maintained for two years. Seattle also created regulations for TNC drivers, requiring them to have both a valid Washington driver's license and for-hire license, in addition to having visible TNC vehicle endorsement, such as a sticker or decal on their vehicle.

Other cities have taken similar action, such as Columbia, Missouri, where the City Council passed regulations that required TNC drivers to possess a valid Missouri chauffeur license in addition to one million dollars of liability insurance (TLPA 2015). The City of Orlando, Florida implemented legislation in December 2014 that required TNCs to obtain a city permit and charge the same fares as taxi companies (TLPA 2015).

A different approach to regulation was adopted in Washington, D.C.; TNCs were legalized under the Vehicle-for-hire Innovation Amendment Act (VIAA) in 2014 (Bond 2015; Posen 2015). The VIAA did not require TNCs to comply with taxi licensing and regulations, but instead set a minimum insurance

requirement, mandated background checks on drivers, and required vehicle inspections (Bond 2015; Posen 2015). Washington D.C. is one of fourteen cities and states that have passed pro-TNC legislation to permit the operation of these entities (Posen 2015).

In sharp contrast, instead of implementing legislation to manage these services, some jurisdictions have issued cease-and-desist orders to TNCs. In Pennsylvania, the Public Utility Commission issued a cease-and-desist order to TNCs Uber and Lyft, and they faced fines of $1,000 for each day they remained operational (Cannon and Summers 2015). Many cities, states, and countries worldwide have banned Uber for various reasons including consumer safety, licensing regulations, and protection of local taxi and transportation industries (Grant and Khosla 2015). In 2013, the California Public Utilities Commission (CPUC) determined that Lyft, SideCar, and Uber had been operating illegally and issued monetary citations (Heuckroth 2013). As of April 2015, ridesourcing was fully banned in 19 places worldwide and partially banned in 6 (Grant and Khosla 2015). Countries that have fully banned TNCs include Belgium, Brazil, France, Germany, India, Italy, and the Netherlands (TLPA 2015). Some Canadian cities that have banned Uber, such as Edmonton and Calgary in Alberta, have allowed locally-operated TNCs. TappCar is a locally owned TNC that serves only Calgary and Edmonton. Similar to the majority of TNCs, the fares of TappCar are cheaper and rides are booked and paid using a profile on the company's mobile app.

One of the main legal issues associated with TNCs is accountability due to the fact that liability for the actions of TNC drivers has been unclear (Pfeffer-Gillett 2016). As mentioned above, TNCs claim no responsibility for drivers since drivers are not employees. Instead, TNCs only claim responsibility for the platform (i.e., the app) that connects drivers with customers (Geisser 2015; Posen 2015). As a result, states and cities that have implemented TNC legislation often attempt to diminish this loophole through mandatory minimum insurance requirements (Pfeffer-Gillett 2016). The relationship between TNCs and their drivers has been widely discussed by legal academics who seek to determine legal liability for the actions of the drivers (Pfeffer-Gillett 2016). Policy recommendations for TNCs have been proposed by the California Public Utilities Commission (CPUC) and the California state legislature. These include requiring driver background checks, requiring that drivers have an employee status (as opposed to self-employed status), and minimum passenger wait time requirements (Pfeffer-Gillett 2016; Rassman 2014). These recommendations are designed to further close loopholes that exist for TNCs who claim to not be liable for the actions of their drivers.

Legal academics are not alone in the search to answer questions about liability for TNC drivers, who have themselves asked the same questions. As an illustration of this point, a recent court decision (O'Connor v. Uber Technologies Inc. (No. C-13-3826)) explored the classification of Californian Uber drivers prior to June 2014. The plaintiffs, Uber drivers, challenged their classification as independent contractors, claiming to be Uber employees (Ross 2015). As employees, drivers would be entitled to reimbursement for expenses including gas, insurance, and car maintenance, in addition to receiving the California minimum wage (Ross 2015). Furthermore, classification as employees would mean that Uber is liable for incidents caused by their drivers. The primary arguments in O'Connor v. Uber hinged on outward representations by Uber about the role of drivers and internal treatment of them (Ross 2015). Drivers claimed Uber treated them like employees, providing feedback on their performance where in some cases drivers were banned from driving for Uber if they had consistently received low ratings from customers (Pfeffer-Gillett 2016). Ultimately, drivers argued that Uber treated them like employees in every respect except in terms of liability coverage (Davis 2015; Pfeffer-Gillett 2016). The case was settled in May 2016 when Uber offered $100 million to the 15,000 plaintiffs (Alba 2016). However, the classification was left in place and drivers

continue to be classified as independent contractors (Kerr 2016). O'Connor v. Uber Technologies Inc. is not the only case of its kind to be taken to court. Similar cases include Yucesoy v. Uber in Massachusetts, DiNofa v. Uber in Philadelphia, and Bruster v. Uber in Ohio.

In recent years, TNCs have had little success arguing that they are merely a platform to help drivers locate customers (Pfeffer-Gillett 2016). TNCs often argued that they were similar to auction websites such as Craigslist or Kijiji, who provide a platform for users to buy and sell products (Pfeffer-Gillett 2016). This argument was overturned by a London court in the United Kingdom in October 2016 with a decision in Aslam, Farrer, and Others v. Uber that ruled Uber drivers were employees, and not independent contractors (Kerr 2016). This decision underscored the level of control that Uber Technologies Inc. has over its drivers, noting that drivers who scored below 4.7/5 on the rating scheme were prohibited from using the app (Pfeffer-Gillett 2016). Uber further controls drivers through regulating the fares, in addition to collecting 20% of each fare (Pfeffer-Gillett 2016). In comparison to an auction site such as Craigslist or Kijiji, unlike Uber the aforementioned auction platforms do not regulate pricing, such as setting minimum or maximum prices for items sold (Pfeffer-Gillett 2016). Additionally, they do not keep a portion of the money earned from selling an item using that platform. As such, auction platforms provide a more "hands-off" approach to their platform, and a representative only becomes involved when a complaint is made against a buyer or seller (Pfeffer-Gillett 2016). In light of this comparison, the London court acknowledged that Uber did not simply provide a platform that showed customers a map of available cars (Pfeffer-Gillett 2016).

Effect on taxi companies

Due to their similar nature, transportation network companies have had a significant influence on the taxi industry. Since the influx of TNCs, there has been a reduction in trips taken by taxis, which taxi companies have largely attributed to the lack of regulations for TNCs. Taxi companies are subject to strict city and state guidelines in order to operate, and to date no such wide-spread regulations for TNCs exist. Research has shown that as the number of TNCs increases, the use of traditional taxis decreases (Chen et al. 2015; Geisser 2015). In 2015, an overall 65% decrease in taxi use occurred in San Francisco compared to 2013 (Bond 2015; Geisser 2015). In San Francisco, the birthplace of Uber, the company accounts for 71% of all "taxi" rides (Chen et al. 2015). As part of their annual Travel Decision Survey, the San Francisco Municipal Transportation Agency (SFMTA) calculated that taxis provided 22,000 trips per day in San Francisco and TNCs provided 47,000 trips (SFMTA 2016). In 2013, the San Francisco Cab Drivers Association reported that one-third of the 8,500 taxi drivers left their job to drive for a private transportation company since TNCs have fewer restrictions, and drivers can choose their own hours (Isaac 2014).

To illustrate the difference in regulation, taxi companies must adhere to specific regulations in order to remain operational within each jurisdiction. For example, taxi medallions are required for any taxi operating in New York City. Medallions are small plates attached to the exterior of a taxi and certify the legal authority of the car to pick up passengers for a fee (Bond 2015). Taxi medallions are a result of the Haas Act of 1937, which not only regulates fixed rates, financial responsibility, the condition of vehicles and the assurance of services, but also the official administration of taxi licenses and medallion system (Bond 2015; Posen 2015). The medallion has allowed New York City's government to maintain control of both the quality and quantity of taxi drivers, as only a certain number of medallions were sold under an artificial cap created by the Taxi and Limousine Commission in 1971 (Bond 2015). Due to this unofficial limit on the number of operational taxis, medallions were priced at $125,000 in the 1980s (Bond 2015). As time

passed and taxis became an increasingly popular means of transportation, the price of medallions increased to more than $1 million in 2010 (Bond 2015). Once TNCs entered New York City, taxi companies faced competition, something they had not experienced prior to TNCs, which decreased the cost of a medallion by 50% as of March 2016 (Dills and Mulholland 2016). This decrease can be partially attributed to the fact that to drive for a TNC, drivers only need a car newer than 2005, personal car insurance, and registration with the company, which is not an expensive certification (Posen 2015; Dills and Mulholland 2016). While in some cases legislation requires TNC drivers to display the company's logo on their car as a form of identification, these logos can be printed off the company's website or sent to drivers once they have registered.

Vehicle inspections are another regulation imposed upon taxi companies. In New York City, taxis are inspected at least three times annually, whereas private vehicles driven for TNCs are inspected only once a year or not at all (Dills and Mulholland 2016). This is largely because taxi drivers are deemed employees of the company, who requires the inspections, whereas TNC drivers are not. Therefore, taxi companies are liable for any damage or collisions caused by one of their drivers while on duty (Pfeffer-Gillett 2016). As a result, it has been argued that taxi companies hold a higher standard of care and maintenance for their vehicles, as the vehicles are generally company-owned and operated (Pfeffer-Gillett 2016).

The method of payment has also been cited as a reason why TNCs are preferred over taxis. The majority of taxi companies accept payments in the form of cash, credit, or debit, where customers can swipe their card on a portable card swipe machine. In contrast, TNCs only take payments through their mobile app using the customer's credit card or PayPal account (Bond 2015). As soon as a driver indicates on their app the trip has ended the customer's account is charged and an electronic receipt is sent to the customer's email account (Bond 2015).

Another factor that has increased the use of TNCs and decreased the use of taxis is cheaper fares. Fare calculations by TNCs are dependent on local transportation laws and the type of service that a customer has chosen (i.e., a luxury service or standard taxi service) (Chen et al. 2015). Fares generally consist of the same factors, such as a base fare, cost per mile, per minute, and any fees or tolls (Chen et al. 2015). Although taxis have a similar method to determine the cost of a trip, TNCs are typically a cheaper alternative. After comparing the price of taxis with UberX and Lyft in Los Angeles, a recent study showed that UberX and Lyft were cheaper than taxis more than 95% of the time. Similarly, in San Francisco, UberX and Lyft were cheaper 72% to 75% of the time (Geisser 2015).

Prominent transportation network companies

While Uber may be the most well-known TNC, there are many TNCs in operation. Several countries world-wide have a form of TNC that operates alongside taxi companies. This section highlights a few of the popular TNCs that exist globally and describes their implementation, services offered, and locations available, in addition to information about pricing and mobile platforms.

Cabify. This entity is the largest TNC in Spanish and Portuguese-speaking parts of the world, operating in Latin America, Spain, and Portugal (Cabify 2016). The company was created by Juan de Antonio in 2011 and provides two main services: one for corporate clients and another for private passengers. Cabify offers both on-demand and reservation services. It was initially launched as a luxury service called Cabify Executive that consisted of high-end vehicles that were more expensive than local taxis. Over time, the company introduced Cabify Lite, which was similar to a typical taxi service, but provided cheaper fares. Additional business services include Cabify Access, which consists of wheelchair-accessible vehicles; Cabify Express, a delivery service; and, Cabify Bike, a bike-sharing service in Chile. Cabify drivers are required to undergo

a selection process and must pass a psychometric test, alcohol and drug test, and a city orientation test. Additionally, they must show they have no criminal record or traffic violations.

Consistent with a majority of TNCs, Cabify operates using a mobile application available for download on Androids and iPhones. Users create an account on the app that links to their credit card or PayPal account, and the account is charged after the ride is finished. Unlike many TNCs, Cabify introduced a cash payment option in Peru in early 2016 called Cabify Cash. In terms of fare calculation, Cabify charges per kilometer of the optimal route, which means that passengers are charged for the most direct route to their destination, regardless of the actual route chosen by the driver. In contrast to some TNCs, Cabify offers fixed pricing, meaning that the price is not dependent on the time of day or the current weather.

Careem. This company was founded in Dubai by Mudassir Sheikha and Magnus Olsson in 2012. As of March 16, Careem operates in ten countries and twenty-five cities across the Middle East and North Africa.

The company was initially founded as a website-based service for car bookings and later evolved into an app due to increased demand. Careem now offers seven travel services and the most popular one is similar to an average taxi service. Recently, the company introduced a travel service called Amira which is a service for women only. All Amira drivers are women, and only women can request the service. This service was created to increase the feeling of safety among female passengers and decrease violence against women who travel alone.

Careem offers both on-demand and booked rides so that users are able to schedule rides ahead of time. Unlike the majority of ridesourcing companies, customers can not only book through the mobile app, but also through a call center. Customers are able to pay by either cash or a credit card linked to their account. On average, Careem costs $0.17 more per kilometer travelled and is slightly more expensive than Uber.

Didi Chuxing. Founded by Chéng Wéi and Liu Qing in 2012, Didi Chuxing, formally called Didi Dache and DidiKuaidi, is the largest ridesourcing company in China. As of May 2016, it was estimated that Didi Chuxing provides rides to nearly 300 million users across of 400 cities in China (Byford 2016).

Didi Chuxing offers seven main services for users, all of which can be requested through the company smart phone app. The services are as follows: DiDi Chauffeur, DiDi Bus, DiDi Test Drive, DiDi Car Rental, Didi Taxi, DiDi Enterprise, and Hitch, a social ridesharing platform. Additionally, partnerships with Grab, Lyft, and Ola allow visitors to travel with Didi using their preferred app so they can book and pay for their travel as they would at home.

Lyft. This company was launched in 2012 in San Francisco by Logan Greene and John Zimmer, the creators of the popular rideshare company, Zimride. Lyft provides rides through a mobile app, matching customers with nearby drivers based upon the GPS in the user's phone. The company is widely known for the pink moustache and all drivers must have one displayed so that customers are able to easily identify which car is for them. While initially the moustache was fastened to the car grill, the logo is now commonly displayed on the dashboard.

As of April 2016, Lyft was available in 200 U.S. cities (Brazil and Kirk 2016). The mobile app allows users to create an account that is linked to their credit card, Google Wallet, or PayPal account for payment. Pricing is calculated using a base fare and a pre-set cost per minute is added. For example, in Pittsburgh, Pennsylvania, Lyft has a base charge of $1.35, with an additional cost of $0.27/minute (Ridesharing Driver 2016).

Lyft offers both on-demand and future ride services; in other words rides can be scheduled up to 24 hours in advance. For future rides, changes can be made or it can be cancelled penalty-free up to 30 minutes before the scheduled ride. Lyft offers four services: Lyft, the original service that matches customers with nearby drivers, Lyft Line matches customers with other riders who are going in the same direction, Lyft Plus offers customers a six-seater car, and Lyft Premier is a high-end luxury ride. Both Lyft Premier and Lyft Line are available in select U.S. cities, whereas Lyft and Lyft Plus are available nation-wide.

Uber. This ridesourcing service matches customers with nearby drivers (Chen et al. 2015). Uber was created in 2009 by Garrett Camp and Travis Kalanick in San Francisco (Bond 2015). The first test run of the company occurred in New York in January 2010 using only three cars. It was fully launched in San Francisco later that same year (Bond 2015). The company initially provided only a black car service, but as interest increased, UberX was introduced providing a service similar to taxis (Bond 2015). As of August 2016, Uber was available in 66 countries and 507 cities world-wide (Uber 2016). It is estimated that Uber services are available to 64% of the U.S. population (Isaac 2014). Customers are charged based on the time of the trip and distance of travel. During high-demand periods, Uber implements surge pricing, meaning that rates increase during peak periods (Chen et al. 2015). Surge pricing typically occurs during periods of poor weather, rush hour, and holidays. Uber has justified surge pricing by claiming that it reduces wait times for users as the high prices deter some from using the service. Additionally, the surge increases profits for drivers and incentivizes driving which increases the number of available cars (Chen et al. 2015).

Surge prices typically update every five minutes and are based on location. For example, an area with a high concentration of bars and nightclubs would experience surge pricing around closing time when demand for rides within this area is higher (Chen et al. 2015). It also occurs during times of poor weather, or on holidays such as New Year's Eve and American Independence Day. While many customers complain about the price increase, Uber has received heightened criticism for surge pricing during situations such as the 2014 Sydney hostage crises. During the crisis, users in the Sydney Business District who were trying to leave in order to protect themselves from the gunman experienced surge pricing that resulted in fares that were up to four times more expensive than normal charges (Lapowsky 2014).

Research has indicated that surge pricing does not occur as frequently as it may appear. A 2015 study of this phenomenon showed that 83% of the time Manhattan did not experience surge pricing, whereas San Francisco did not experience surge pricing 43% of the time (Chen et al. 2015). Additionally, results revealed that 40% of price surges lasted less than one minute (Chen et al. 2015). Despite the use of surge pricing, travelling with Uber remains cheaper than travelling with a traditional taxi (Chen et al. 2015).

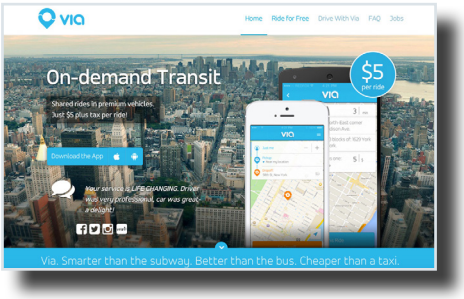
Customers that use Uber download a mobile application and create an account. Users must provide an e-mail address, cell phone number, and credit card or PayPal information in order to verify their account. When customers want a ride they open the app and the GPS in their phone determines their location in addition to the location of available drivers that are nearby (Isaac 2014). Users must enter the drop-off location, at which time the cost of the trip is provided. Customers then click "Request Uber," and are paired with a driver. The GPS allows customers to see where the driver is in relation to the pick-up location, as well as an estimated time of arrival (Isaac 2014).

Uber offers a variety of different services: UberX and UberXL are basic sedans and SUVs that compete with traditional taxi companies; UberBLACK and UberSUV provide luxury vehicles that compete with limousines; UberFAMILY is a subset of UberX/XL, but is equipped with car seats; UberWAV consists of wheelchair

accessible vehicles; UberT allows users to request traditional taxis within the mobile app; UberPOOL allows users to save money via carpooling and multiple passengers are assigned to each vehicle; and, UberRUSH, is a delivery service that couriers packages on behalf of customers.

As mentioned previously, Uber has faced many legal challenges due to claims that Uber drivers do not work for them but are instead self-employed (Chen et al. 2015). Uber is unlike typical transportation providers such as taxi companies who employ drivers and provide them with a vehicle and gas (Chen et al. 2015). In contrast, Uber drivers use personally-owned vehicles and pay for their own gas, repairs, upkeep, and insurance. As a company, Uber states that it only provides a platform (i.e., the app) which connects customers with drivers (Chen et al. 2015).

Via. This service was founded by Daniel Ramot and Oren Shoval in 2012, who wanted to create a service that addressed flaws they believed existed in the taxi industry. Operating in four locations in the United States, Via is distinct from other ridesourcing programs in two key ways. First, users are not picked up or dropped off at an exact location, but instead on the corner of a block nearest to their location. This method provides faster service. Second, Via offers a flat rate of $5 for all travel. Regardless of the length of time spent in the vehicle or distance travelled, the ride always costs $5. This price is significantly cheaper than other ridesourcing services, where fares are calculated based on the distance travelled, the time spent in the vehicle, or a combination of both.



Kargas, C. December 2015, Ridesharing. Transportation Evolution Institute. Retrived from https://teiet.org/2015/12/16/ridesharing-4/ on April 27th , 2017

Within the past five years, TNCs have become an increasingly popular method of travel due to their low cost fares and the ease of hailing one through a mobile app, although it is worth noting that these programs do not have universal appeal to all potential users. Of interest, the Deloitte Global Automotive Consumer Study surveyed 22,000 consumers across seventeen countries and asked the frequency participants used ride-hailing services. Participants could respond with "never", "rarely", or "at least once a week". Responses ranged from 4% using the service at least once a week (Japan) to 47% (India). Half of the 1750 participants from the United States stated they never use a ride-hailing service, with 23% indicating they do at least once a week. Participants who indicated they use ride-hailing services were then asked if they questioned the need to own a vehicle in the future. Generation Y and Z (born 1977 to 2012) participants had the highest rate of questioning the need to own a car across the countries surveyed, and Baby Boomers (born 1946 to 1964) had the lowest rate (Deloitte 2017).

Summary. For-profit safe rides, or TNCs, are companies that provide transportation to customers who request travel and pay using the mobile app. While similar in their purpose, the six TNCs described in this section employ different methods to appeal to their customers.

Generally speaking, TNCs have had a disruptive effect on the taxi industry since more customers opt for the cheaper alternative of a TNC. As a result of the increased growth and use of TNCs, cities and states have been tasked with creating legislation that effectively regulates the growing impact of TNCs on local jurisdictions. To date, legislation has been developed although some jurisdictions have chosen to regulate TNCs while others have banned their use entirely.

Non-profit safe rides

Similar to TNCs, non-profit safe ride programs also provide reliable transportation, however they do so free of charge. The operation of these programs is examined in more detail in this section. To begin, these

programs are defined and three primary types of non-profit programs are discussed: university operated, local law enforcement operated, and privately owned and operated.

Definition

Non-profit safe ride services are a free or low-cost ride home for drinking drivers and their passengers (Caudill et al. 2000; Gieck and Slagle 2010). These safe ride programs supplement normal public transportation provided by subways, buses, and taxis (Decina et al. 2009; NHTSA 2015). Non-profit safe rides have also been called alternative transportation options (Decina et al. 2009; NHTSA 2015). In contrast to TNCs, many safe ride programs are only offered on weekends and holidays when alcohol-related traffic incidents occur at a higher rate (Caudill et al. 2000; Sarkar et al. 2005). While the majority of programs solely offer a ride home, some safe ride services drive users home in their own vehicle so they do not need to retrieve it the next day (Sarkar et al. 2005). Safe ride programs are run by many different types of organizations including bus companies, charitable organizations, hospitals, and government agencies (Sprattler 2010). The availability of the program in addition to the frequency of the service, cost, and modes of operation differ from program to program (Sprattler 2010). Many universities and colleges have safe ride programs that are funded by the student government. These programs are not only for persons who have been drinking, but also for students who may be afraid to walk home in the dark and prefer a ride home (Weber 2014).

One criticism of non-profit safe ride programs is that they promote increased consumption of alcohol (Harding et al. 2010). However, a survey of safe ride users showed that only 19% indicated that they consumed more alcohol because they knew the safe ride was available, whereas 81% stated that having the safe ride did not influence their consumption (Gieck and Slagle 2010). While increased consumption may be a concern, research has shown that increased drinking is uncommon and safe ride programs attract passengers who are at higher risk to drive while alcohol-impaired (Gieck and Slagle 2010; Huseth 2012; Sprattler 2010).

University operated safe ride programs

Safe ride programs that are operated by universities are typically operated by students and consist of buses or vans that transport students to and from bars, on-campus housing, and nearby apartment complexes and neighborhoods (Dornier et al. 2010). Many of these programs began in response to increased concerns about violence against young women who walked home alone. Over time, these programs have become an alternative to drinking and driving (Caudill et al. 2000).

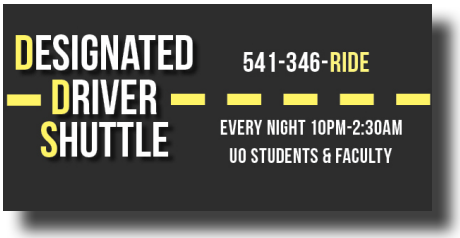
There are three common types of university operated safe ride programs: fixed-route shuttles, point-to-point shuttles, and taxi-like services (Decina et al. 2009). Fixed-route shuttles provide a service similar to a city bus service, following a fixed route on campus (Decina et al. 2009). Fixed-route shuttles typically are not promoted as an alternative to alcohol-impaired driving since they generally do not provide service to downtown urban centers. However, these shuttles usually operate during periods of higher drinking activity and may serve as an alternative to alcohol-impaired driving to some users (Decina et al. 2009). Point-to-point shuttle programs provide rides that are dispatched from a point on campus to the location requested by users (Decina et al. 2009). Depending on the program, services may not be available to the downtown area and instead may only provide rides within a certain radius of the university campus (Decina et al. 2009). Lastly, taxi-like university safe ride services are similar to TNCs and provide rides to students from campus to the location of their choice (Decina et al. 2009).

University operated safe ride programs are financed in a variety of ways. Funding can come from student

fees, private donations, and grants (Dornier et al. 2010). Additionally, while the majority of programs are free for students, some programs request a small fee from passengers who are not students in order to help fund the program (Dornier et al. 2010). In a 2010 survey conducted at Southeastern Louisiana University, 78.6% of students stated that they would support a university-run safe ride program for a $10 fee per semester (Dornier et al. 2010). Midwestern University in Arizona has a safe ride program that charges students a one-time fee of $30 which is included in student fees as part of tuition (Elam et al. 2006).

In 2014, the National Center for Education Statistics reported that 34% of public, four-year universities and 24% of private four-year universities had safe ride programs (Weber 2014). The prevalence of university run safe ride programs is important since alcohol-impaired drivers aged 21 to 24 (i.e., university-aged drivers) are responsible for more alcohol-related crashes and fatalities than any other age group (Rivara et al. 2012). Furthermore, the largest proportion of alcohol-impaired fatally injured drivers (32%) involves drivers aged 21 to 24 (Rivara et al. 2012; Sarkar et al. 2005).

The University of Oregon has a student-operated sober shuttle program which is funded and run by student volunteers. The University supports the project but does not offer any financial aid to support the program (Dornier et al. 2010). While not delivered by the university, the City of Baltimore offers a sober shuttle to students attending one of the five local universities. In order to use the free service, students must show their student identification card prior to boarding the bus (Dornier et al. 2010). In 2004, an estimated 65,000 students used the service (Dornier et al. 2010).



ASUO Designated Driver Shuttle Retreived from http://asuodds.weebly.com/ on Jan 20th, 2017

While some universities have programs that are available seven days a week, many only operate on certain days. For example, the student government at Pittsburg State University implemented a safe ride program that only operates Wednesdays through Sundays from 11:00p.m. to 2:30a.m. (Dornier et al. 2010). The program at Midwestern University is offered Thursday through Saturday from 11:00p.m. to 4:00a.m. (Elam et al. 2006).

In 2010, nearly 200 passengers were interviewed during their trip in a study of a university-run safe ride program in the United States (Gieck and Slagle 2010). The program consisted of three small vans that provided rides on Thursday, Friday, and Saturday from 7:00p.m. to 2:30a.m. Among the passengers interviewed, 75% stated that they primarily used the safe ride service to avoid driving while alcohol-impaired (Gieck and Slagle 2010). Similarly, a 2005 survey of safe ride users in California showed that 44% of passengers said they would have driven home while alcohol-impaired had the safe ride not been an option (Sarkar et al. 2005). In addition, the 2010 study estimated the total savings associated with alcohol-related costs and showed that approximately $3.00 was saved on impaired driving costs for every $1.00 spent by the local community to operate the program, although these types of costs were not specified. Typically, university operated safe ride programs are more cost-efficient than increased police presence to deter impaired driving. On average, students pay a $10 fee per semester that is collected as part of tuition and this is significantly cheaper than the cost of assigning more officers to detect impaired drivers (Weber 2014).

Law enforcement operated safe ride programs

In some jurisdictions, local law enforcement agencies operate safe ride programs in an effort to decrease impaired driving arrests, crashes, and fatalities. This is perceived to be a more cost-effective method than increasing police patrols to detect impaired drivers.

The Cleveland Police Department in Cleveland, Minnesota has implemented a safe ride program called Sober Cab. The program was started in 2004 after the police department was criticized for making too many impaired arrests in 2003. The department reasoned that critics could not condemn the police department for the number of arrests after giving everyone the option of a free ride home and drivers chose not to use it (Sprattler 2010; Tiegs 2015). The program is funded entirely by the police department budget and typically one squad car is used per night (Tiegs 2015). However, when the demand is high on holidays a second car is assigned to the Sober Cab safe ride program to ensure the option is available for everyone (Tiegs 2015).

Sober Cab offers free rides year round from 6:00p.m. to 2:00a.m. In addition to providing transportation from bars, Sober Cab also drives passengers home from the liquor store. People who are too alcohol-impaired to drive can either call Sober Cab or ask the bartender to make the call; an officer arrives shortly afterwards to take the person home. In 2009, the program provided 145 rides and use has increased each year (Sprattler 2010; Tiegs 2015).

The Slidell Police Department in Louisiana also offers a safe ride program. The program was implemented in 2012 but only operates for two weeks starting just prior to Christmas and extending into the New Year. People who have consumed alcohol and do not have a designated driver are able to call the police department and request a free ride home. Holiday-specific safe ride programs are common among police departments, as impaired driving arrests, crashes, and fatalities increase during this time (NHTSA 2009).

Tipsy Taxi is a safe ride program operated by the Pitkin County Sheriff's office in Aspen, Colorado. The service started in 1983 and provides free, confidential rides to passengers who have had too much to drink seven days a week, year round (NHTSA 2000). Funding for the program primarily comes from fundraising events, grants, alcohol license fees, and fees for impaired driving offenders (NHTSA 2000).

Privately owned and operated safe ride programs

In some communities, citizens create and operate their own safe ride programs in order to reduce impaired driving-related crashes. The majority of these programs do charge a fee, however the fee merely covers the costs to operate the program (Huseth 2012). Many of the privately owned and operated safe ride programs are delivered in rural areas as a result of a limited number of taxis, and the unavailability of service on bus routes before midnight (Huseth 2012). To address these problems, members of communities create programs so that people can get home safely.

Implemented in 2007, Breezy Point, Minnesota has a safe ride program that operates seven days a week, year round (Sprattler 2010). The service is free between 6:00p.m. and 10:00p.m. After 10:00p.m. customers pay $10 and are given a wristband which entitles them to unlimited transportation to bars, between bars, and home at the end of the night (Sprattler 2010). The Breezy Point program is funded by approximately twenty local bars who contribute between $200 and $400 a month to deliver the program (Sprattler 2010). Transportation is only offered to and from these participating bars and either customers or a bartender can call for a ride (Sprattler 2010). In 2009, it was estimated that the program provided 300 rides per weekend (Sprattler 2010).

The Isanti County, Minnesota safe ride program provides rides home to passengers between Thursdays and Sundays from 10:00p.m. to 2:00a.m. (Sprattler 2010). The service is free for rides up to $15 and riders who exceed that fare pay the difference (Sprattler 2010). Funding comes from five primary sources: local bars and restaurants, a local beer distributor, a community fund, grant funding, and passenger fees for rides exceeding the $15 limit (Sprattler 2010). The program started operating in 2005 and in 2009 it provided approximately 725 rides home (Sprattler 2010).

The Last Call safe ride program provides service in four Minnesota cities: Virginia, Eveleth, Gilbert, and Mountain Iron. Operating since 2000, Last Call provides service year round to passengers who receive a voucher for a free ride from participating bars and restaurants (Sprattler 2010). Bar patrons can receive this voucher by requesting one from the bartender. Costs of the safe ride service are shared between the bar or restaurant where the passenger was last drinking (50%), a local beer distributor (30%), and the taxi company (20%) (Sprattler 2010). In 2009, Last Call provided more than 1,000 rides home to passengers who were too impaired to drive (Sprattler 2010).

The Washington Regional Alcohol Program (WRAP) is dedicated to preventing alcohol impaired driving and underage drinking in the Washington-metropolitan area. The WRAP SoberRide program provides free or deeply discounted rides during key holidays around the Washington, D.C., region. Since 1993, SoberRide has provided more than 65,219 safe rides home (WRAP 2017).

Operation Red Nose is an annual holiday campaign in Canada that provides free rides home to alcohol-impaired drivers. Launched in Quebec City in 1984, Operation Red Nose has more than 55,000 volunteers that have provided 76,000 rides annually in seven Canadian provinces (Alberta, British Columbia, Manitoba, New Brunswick, Ontario, Quebec and Saskatchewan). Users can call their local Operation Red Nose dispatch number or use the recently released app to request a ride, similar to requesting a ride with Uber or Lyft.

Similar to Operation Red Nose, AAA (American Automobile Association) has a Tow-To-Go program in select states across the U.S. during holiday seasons. Unlike Operation red Nose, Tow-To-Go is not exclusive to the winter holiday season, but also operates during Super Bowl Sunday, Thanksgiving, Independence Day, and other holidays throughout the year. The Tow-To-Go program provides free rides home to drivers who are alcohol impaired (AAA, 2017). The offer is not exclusive to drivers with AAA memberships; anyone can request a ride within a 10-mile radius from the Tow-To-Go service, which will transport the driver and their vehicle.

Unlike many safe ride programs that provide only a ride home, the Sober Guy Cab Service in North Dakota provides not only transportation home, but also an additional driver who takes the customer's car home (Huseth 2012). The service costs $17 and runs seven days a week.

Similar to the Sober Guy Cab Service, many Canadian safe ride programs drive passengers home in their own vehicle. Safe-T-Ride in Toronto provides rides to alcohol-impaired passengers who either book online or by phone. This service was first offered in 2004, and rates are dependent on the distance travelled, with a starting rate of $40 for rides up to 15km. In Barrie, Ontario, Canadian Designated Drivers provide rides home to passengers in their own vehicle seven days a week for a flat rate of $25; SoberGirls in Vancouver, British Columbia provides the same service.

A more unique service is a Scooter program. Scooter programs consist of an individual riding a foldable scooter to meet the customer, an impaired driver, at their vehicle. At the vehicle, the sober driver folds the scooter, places it in the car, and drives the impaired person home in their own vehicle, at which time the driver is able to drive their scooter to the next customer (Meece 2009).

Summary. There are many safe ride programs that provide free or low-cost rides to alcohol-impaired passengers. The primary objective of these programs is to reduce the number of alcohol-related arrests, crashes and fatalities and ensure that everyone has the option of a safe ride home. Generally, these programs are community-based and arise out of an immediate need to overcome limited transportation options and reduce impaired driving. Although these services may be managed by a variety of entities and a fee may be imposed for either longer trips or certain types of customers, they are otherwise highly similar in structure and operation.

EFFECTS OF SAFE RIDES

Most non-profit safe ride home programs are established to help decrease the number of alcohol-impaired driving arrests, crashes, and fatalities. While for-profit safe ride home programs provide transportation in general that is not specific to alcohol-impaired customers, they have recently been commended for decreasing the number of impaired driving-related incidents, for example through promotions by Uber and Lyft. This section describes studies that have examined whether or not safe rides have influenced the number of impaired driving arrests, crashes and fatalities. It is important to note that a limited amount of research currently exists that explores the effect of safe rides since they are a relatively new phenomenon. This section contains a summary of key findings from studies that have examined the effect of both TNCs and non-profit safe rides on alcohol-related traffic incidents.

Alcohol-impaired driving arrests

A case study examined the effect of Uber in Chicago on impaired driving arrest rates before and after the entry of Uber (Chicago 2015). Results suggested there was a relationship between a person's decision to drive while impaired and the availability of Uber based on data that showed a 10.5% decrease in impaired driving arrests after Uber entered the market between 2012 and 2013 (Chicago 2015). Additionally, requests for an Uber were highest between the hours of 10:00p.m. and 3:00a.m., during the same period when impaired driving rates were highest (Chicago 2015). To further examine this spike in ride requests, researchers compared the number of requests from locations where alcohol was, and was not, served and found that the majority of requests came from locations with an alcohol license (Chicago 2015). Miami and Pittsburgh also experienced a similar spike in Uber usage at the time bars closed, which are the same historical times as impaired driving arrests and crashes (MADD 2015). These results are consistent with findings from a 2015 study that examined the effect of the availability of Uber on impaired driving arrest rates in Seattle (MADD 2015). This 2015 study indicated a 10% decrease in impaired driving arrests between 2013 and 2014 following the arrival of Uber in Seattle in 2012 (MADD 2015).

A 2016 study that used the Federal Bureau of Investigation Uniform Crime Reports (UCR) was based on a difference-in-differences evaluation to examine whether the entry of Uber was associated with changes in impaired driving arrest rates (Dills and Mulholland 2016). A difference-in-differences evaluation uses a robust study design where outcomes are compared for two groups (an experimental group and a comparison group) across two time periods (before and after the implementation of a new measure).

Such a design enables one to control for a variety of confounding factors, thereby ruling out alternative explanations of the observed effect with a high degree of certainty. Results indicated that a one-time, 33% decrease in impaired driving arrests occurred after Uber entered various counties across the United States (Dills and Mulholland 2016). After this initial decrease the average rate of decline following the entry of Uber was 51.3% per year (Dills and Mulholland 2016).

A 2015 study that used UCR data about impaired driving arrests in metropolitan areas in Philadelphia examined the effect of the entry of both Uber and Lyft on arrest rates (Good 2015). Using a difference-in-differences method, data were collected about arrest rates between January 2004 to January 2013 prior to the entry of Uber and Lyft. During this nine year span there was an average of 1,262 impaired driving arrests each month (Good 2015). After the entry of ridesourcing companies, the average number of impaired driving arrests per month decreased by 11.1% (to 1,122 per month) (Good 2015). While results indicated a decrease in impaired driving arrest rates after the entry of Uber and Lyft, it is important to note that the data prior to the entry consisted of nine years of information whereas the post-entry data consisted of only nine months. As such, definitive conclusions about continued effects, or lack thereof, cannot be drawn.

Midwestern University in Illinois has a Midnight Special safe ride program that offers three bus routes to students who are either too alcohol-impaired to drive, or who are wary of walking alone at night. The program started in 2001 with an average of 2,430 riders per semester; this increased to 16,558 in 2003 (Elam et al. 2006). To examine whether or not the Midnight Special program had an effect on impaired driving arrest rates, researchers obtained arrest data from the campus (MUPD) and city (CPD) police departments. The CPD reported an increase in impaired driving arrests between 1998 and 2001 (from 294 arrests in 1998 to 400 arrests in 2001) (Elam et al. 2006). In 2002, after the implementation of the Midnight Special program, there was a 1.75% decrease in impaired driving arrests according to CPD data (Elam et al. 2006). An examination of campus police data showed an increase from 95 arrests in 2002 to 123 in 2003 (Elam et al. 2006). However, in an interview with the researchers, the MUPD captain attributed this increase to the fact that the legal definition of intoxication in the state was lowered from a blood alcohol content (BAC) of .10 to .08 in early 2003 (Elam et al. 2006). Although data from the two police departments showed conflicting results, when interviewed both police captains agreed that the Midnight Special program not only reduced alcohol-related incidences, but also provided a safe alternative to students who would walk or drive home while alcohol-impaired (Elam et al. 2006).

Many of the studies described in this section emphasized that using a safe ride home is significantly cheaper than being arrested for impaired driving. Whereas a safe ride home as part of these program costs, on average, $20 to $25, it is estimated that an impaired driving arrest can cost drivers between $7,000 and $30,000 in the United States (i.e., hiring a defense lawyer, increased insurance, fines, relicensing fees) (NHTSA 2014; Uber 2016).

Ultimately, these studies underscore that the availability of both for-profit and non-profit safe rides may influence impaired driving arrest rates although their precise effects are as of yet unclear. While the majority of studies showed a correlation between an increase in the availability of safe rides and a decrease in rates of impaired driving and other criminal arrest rates, it is notable that just one study indicated that declining trends in impaired driving arrests, which have been pronounced in the past few years across North America and Europe, were controlled for as part of the study. As such, safe ride programs provide a safer alternative than driving while alcohol-impaired and people do take advantage of these programs, however the effect of such programs on impaired driving arrests is not well understood.

Alcohol-impaired driving crashes

In 2015, Mothers Against Drunk Driving (MADD) conducted a study in California to examine the "Uber Effect." The Uber effect was determined based upon the effect of the availability of safe, reliable rides through the Uber ridesourcing platform on impaired driving crashes (MADD 2015). The results of the study indicated that the number of monthly alcohol-related crashes decreased by 6.5% among drivers under age 30 following the entry of UberX (MADD 2015). Since the entry of UberX in July 2012, it is estimated that 1,800 alcohol-related crashes have been prevented in California (MADD 2015).

The Virginia Department of Motor Vehicles (DMV) conducted a state-wide study in 2015 to examine the effect of ridesourcing companies on impaired driving crashes. A difference-in-differences study that compared rates of crashes before and after the entry of ridesourcing companies revealed a 4% decrease in alcohol-related crashes (Blanton 2016).

An examination of the effects of the non-profit safe ride program, Road Crew in Wisconsin, showed a potential reduction in crashes by as much as 17% in its first year (Huseth 2012). This program charges a small fee and picks up passengers at their home, drives them from bar to bar, and delivers them home at the end of the night (Road Crew 2016). Similarly, the implementation of the Tipsy Taxi safe ride program in Aspen, Colorado has been linked to a 15% reduction in alcohol-related crashes within the county (NHTSA 2000). This reduction was calculated based on an analysis comparing a county with Tipsy Taxi service with nearby counties that did not have a safe ride service. After the entry of Tipsy Taxi, rates of impaired driving crashes declined, whereas rates remained unchanged in counties without the service.

Based on the findings of the studies described above, it can be concluded that there is some evidence that safe ride programs may reduce impaired driving crashes, but more studies are needed to further investigate this issue and confirm the results of available studies. This conclusion is supported in the 2015 Countermeasures that Work technical report published by NHTSA, in which these programs receive a two-star rating (out of five stars) in terms of the effectiveness of safe rides (Goodwin et al. 2015). The two-star rating is defined as "effectiveness still undetermined; different methods of implementing this countermeasure produce different results" (Goodwin et al. 2015, p. 23).

Alcohol-impaired driving fatalities

A California study by Greenwood and Wattall examined the effect of Uber on impaired driving fatalities. Researchers hypothesized that since UberX increased safe ride home options while at the same time decreasing the cost, it would have a positive impact on the number of impaired driving fatalities (Greenwood and Wattall 2016). A difference-in-differences method was used to examine impaired driving fatality data from January 2009 to September 2014 and compare cities where UberX was present with cities that did not have UberX (Greenwood and Wattall 2016). Results indicated a 3.6% decrease in impaired driving fatalities in locations serviced by UberX (Greenwood and Wattall 2016). The study concluded that a national implementation of UberX would result in 500 fewer impaired driving fatalities annually (Greenwood and Wattall 2016), although there was no indication that authors of this study controlled for pre-existing trends in impaired driving fatalities.

Using data from the National Highway Traffic Safety Administration (NHTSA) Fatality Analysis Reporting System (FARS), a 2016 study examined whether the implementation of Uber in the United States was associated with changes in the overall rate of fatal vehicle crashes (Dills and Mulholland 2016). Results showed a 6% decline in alcohol-related fatal crashes, an 18% decline in night-time fatal crashes, and a 16.6% decline in the number of vehicle fatalities (Dills and Mulholland 2016). Additionally, an analysis of

impaired driving data between 2010 and 2013 in areas before UberX entered the market in 2012 showed that the fatality rates were higher before the company entered the market as compared to after services became available, and declined 31.1% (Dills and Mulholland 2016). Of importance, this study included controls for county-specific linear trends, whether marijuana was decriminalized, medicalized, or legalized, and the total and urban vehicle miles traveled.

The Virginia Department of Motor Vehicles conducted a study that examined the effect of ridesourcing companies on impaired driving fatalities. This study also utilized a difference-in-differences method and results revealed a 22% decrease in alcohol-related fatalities between 2014 and 2015 (Blanton 2016).

In sharp contrast, unlike the aforementioned studies, a 2016 study by Brazil and Kirk showed that Uber had little to no effect on traffic fatalities. The 2016 study examined the relationship between the deployment of Uber and subsequent alcohol-related traffic fatalities in the 100 largest metropolitan areas in the United States from 2005 to 2014 (Brazil and Kirk 2016). Researchers examined monthly changes in the number of fatalities within counties using a difference-in-differences approach (Brazil and Kirk 2016). They used controls in relation to yearly alcohol consumption rates in 2014 and the cost of a gallon of gas since these factors have been linked to traffic fatalities. In addition, because economic conditions influence crash risk factors (i.e., alcohol consumption and miles travelled), researchers also controlled for county monthly unemployment rates, which measured the percentage of the labor force aged 16 years and older that was unemployed.

Three categories of traffic fatalities were considered in this study: total, impaired driving, and weekend/holiday-specific. While results indicated that counties experienced an increase in the total number of traffic fatalities during the months Uber was present, the number of weekend/holiday-specific fatalities decreased (Brazil and Kirk 2016). Ultimately, while Uber does provide a cheaper and simple alternative of finding a sober ride, findings revealed that the entry of Uber had no association with the number of subsequent traffic fatalities. Researchers attributed this to the fact that Uber represents a relativity small portion of the transportation market within the United States. As such, the lack of an effect was not surprising when considering the large number of annual alcohol-related traffic fatalities; approximately 10,000 per year (Brazil and Kirk 2016). Furthermore, the authors of the study explained that individuals who choose to drink and drive may not be rational, and therefore do not see the appeal in paying for a service when they could drive home while alcohol-impaired and potentially not get caught. To these individuals, a service like Uber may be perceived as more costly than the risk of driving while alcohol-impaired (Brazil and Kirk 2016).

CONCLUSIONS

This literature review investigated two types of safe rides: for-profit (i.e., TNCs) and non-profit programs. While similar in strategy and delivery, TNCs provide travel options for a profit whereas non-profit safe rides provide travel for people for free or at a low cost. The influx of TNCs in recent years has had a disruptive impact on the taxi industry in several jurisdictions as a result of lower fares and ease of access through TNC mobile apps. Customers no longer have to stand outside waiting for a cab, but can instead request a ride from their phone and are given an estimated time of arrival. Studies have shown that while TNCs indeed have a disruptive impact on taxis, they may also have some positive effects in other areas such as reductions in alcohol-related traffic incidents. Similarly, non-profit safe rides have been correlated with decreases in alcohol-related traffic incidents. Unlike TNCs, no evidence exists to suggest that non-profit TNCs have had an effect on the taxi industry.

Following the immensely successful entry of Uber into the transportation market in 2009, similar TNCs rapidly emerged to meet demand. Lyft, Cabify, Careem, Didi Chuxing and Via are only a few of the multitude of TNCs that exist globally. In response to the success of TNCs, countries, states, and cities have worked to address the challenge of regulating this modern form of transportation. While some jurisdictions have banned the industry entirely, others have implemented legislation to regulate the number of drivers a TNC can have operating within a city, in addition to regulating the licensing and hiring of drivers. Interestingly, some jurisdictions that have banned well-known TNCs such as Uber and Lyft have allowed locally-owned TNCs to operate. In sum, a variety of approaches have been adopted to manage the growing TNC industry.

Non-profit safe rides have aimed to contribute to a decrease in impaired driving arrests by providing alternative options for a ride home. Non-profit safe rides are typically locally-owned and operated, and are increasingly present during the December to January holiday season. Characteristically operated by universities, local law enforcement agencies, and community volunteers, non-profit safe rides offer an alternative to driving while impaired by providing a free ride home.

While studies indicate there may be a reduction in the number of annual impaired driving arrests, crashes, and fatalities associated with safe rides, there is a continued need for research to understand the effectiveness of these programs. Specifically, there is a need for more longitudinal research to examine effects over longer time periods. The majority of the studies mentioned examined the rates of impaired driving arrests, crashes and fatalities before and after the entrance of safe rides home in a particular

jurisdiction. While several of these studies utilized a comparison group as part of the difference-in-differences method, additional research that controls for pre-existing trends is needed to bolster the findings. This is especially true in light of the fact that data pertaining to time periods after safe ride programs have been implemented are limited.

It can be concluded from the research that safe rides do provide safe transportation options to passengers who may have otherwise driven while impaired and for that reason safe rides are a viable alternative to impaired driving. However, while most of the studies conducted to date revealed a positive impact, with the available evidence, it cannot be unequivocally concluded that safe ride programs do indeed reduce impaired driving crashes and fatalities. The evidence available only supports a correlational relationship rather than a causal one. To illustrate this, the 2015 NHTSA technical report on Countermeasures that Work assigned a two-star rating (out of five stars) to the effectiveness of safe rides (Goodwin et al. 2015), demonstrating the need to further study this alternative to driving while impaired. In sum, the available evidence suggests safe ride programs are promising and merit further inquiry, but are not yet proven to definitively reduce the burden of alcohol-impaired driving.

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