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Exploration of the Current State and Directions of Dynamic Ridesharing

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EXPLORATION OF THE CURRENT STATE AND DIRECTIONS OF DYNAMIC RIDESHARING

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ABSTRACT

EXPLORATION OF THE CURRENT STATE AND DIRECTIONS OF DYNAMIC RIDSHAREING

by Joseph J. Di Gianni

Dynamic ridesharing (DRS) is an emerging transportation service based on the traditional concept of shared rides. DRS makes use of web-based real-time technologies to match drivers with riders. Enabling technologies include software platforms that operate on mobile communication devices and contain location-aware capabilities including Global Positioning Systems (Agatz, Erera, Savelsberg, & Wang, 2012). The platforms are designed to provide ride-matching services via smartphone applications differing from early systems that used non-real time services such as internet forums, or telecommunications, where responses were not immediate.

The study of DRS is important when considering its role as an emerging transportation demand management strategy. DRS reduces travel demand on single-occupancy vehicles (SOVs) by filling vehicle seats that are typically left vacant. The most recent statistics of vehicle occupancy rates were measured in 2009 by the National Household Travel Survey (NHTS), conducted by the U.S. Department of Transportation. According to the NHTS, the 2009 occupancy rate for all purposes was a meager 1.67 persons per vehicle (Federal Highway Administration, 2015). Vehicle occupancy rates examined against the total of all registered highway vehicles in the U.S. as of 2012, calculated at 253,639,386 (Bureau of Transportation Statistics, 2015), reveals the magnitude of the impact of SOVs. Left unattended, the ramifications for environmental

outcomes is substantial. Among the major energy consuming sectors, transportation's share is largest in terms of total CO_2 emissions at 32.9% (Davis, Diegel, & Boundy, 2014, p. 11-15).

DRS offers promise to fill empty vehicle seats. Evidence indicates that specific demographic subgroups are inclined to use DRS services. For example, data suggest that the subgroup of 18 to 34-year-olds, the so-called "millennials", have negative attitudes towards private car ownership unlike previous age groups (Nelson, 2013). Data collected for this study revealed that the millennial subgroup represents half of all DRS users. Millennials also revealed they tended to use DRS more than other subgroups to replace a private vehicle. Further research is needed to determine if the trend towards DRS by 18 to 34-year-olds represents current economic factors or a fundamental cultural shift away from the SOV transportation model.

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I would like to thank Dr. Rolf Sternberg, who guided me on this journey of knowledge that has changed my life. He has been both friend and mentor and has taught me not only how to be a geographer, but more importantly, how to be a teacher of geography. I will always be grateful for the limitless encouragement he has shown in believing that I could do this.

I would also like to thank Dr. Gregory Pope, who helped me through the necessary IRB process that made much of this research possible.

DEDICATION

To my mother Susan, and in memory of my father, John. I dedicate this dissertation to them for their love and support.

And

To my brother, John, whose love, encouragement, and support was always there to keep me going.

And

To my friend, Lauri, who never ceased to encourage and support me in this endeavor, and would say, "You can do this!"

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ADA	Americans with Disability Act of 1990
APPS	Applications
CO_2	Carbon Dioxide
CPUC	California Public Utilities Commission
DRS	Dynamic Ridesharing
FHV	For-Hire Vehicle
GHG	Greenhouse Gas
GPS	Global Positioning System
ICT	Information and Communications Technology
NHTS	National Household Transportation Survey
SOV	Single Occupancy Vehicle
SFMTA	San Francisco Municipal Transportation Agency
TDM	Transportation Demand Management
TLC	Taxi and Limousine Commission
TNC	Transportation Network Company
UM	Uninsured Motorist
UIM	Underinsured Motorist

CHAPTER 1

1. Introduction

Each day in North America fixed capacity roads become filled with cars, trucks, and buses as demand volumes rise with resultant slower speeds and frequently stopped traffic. At the same time, unused capacity remains idle in the form of unoccupied seats in millions of passenger cars. Utilizing those empty seats can contribute to reducing vehicle emissions, lowering fuel usage, and creating socioeconomic opportunities from productivity gained through the efficient use of the transportation system. Currently, carpooling is the primary method used to fill empty seats in private vehicles (NHTS, 2009). Major barriers to greater adoption of carpooling, however, have kept its contribution to the overall transportation matrix at low levels (Chan & Shaheen, 2012). Major barriers include issues of private space, conflicting schedules, increased travel time allotted for pick-up and drop-off of passengers, and safety risks to both persons and property (Ferguson, 1997). Despite these barriers carpooling takes place as evidenced by recent U.S. Census data indicating that twice as many people use carpooling in a private vehicle to commute to work than those who use public transportation (Davis, Diegel, & Boundy , pp. 8-20, 2013). With the relative success of carpooling in mind, this study aims to examine a form of trip sharing known as dynamic ridesharing (DRS) which promises to overcome barriers to carpooling and increase the number of occupied seats utilized in private vehicles.

DRS is an emerging automated process facilitated by an online provider that matches drivers with riders in real-time (Agatz, Erera, Savelsberg, & Wang, 2012). The matching provider, generally a software company, uses information, communication, and location-aware technologies in the form of Internet-enabled smartphones and social media websites such as Facebook to match riders with drivers in real-time usually within minutes before the trip takes place (Agatz, et. al, 2012). These enabling technologies are at the heart of renewed interest in DRS, also known as real-time ridesharing. Software companies facilitating DRS are the newest innovation being considered by consumers and are emerging quickly driven by rapidly changing enabling technologies (Deakin, Frick, & Shivley, 2011). Hence, transportation planners are re-examining DRS's potential benefits to reduce traffic congestion and automotive emissions despite an overall 10% decline in the rate of carpooling within the last 30 years (Table 1) (Furuhata, Dessouky, Ordóñez, Brunet, Wang, & Koenig, 2013). Currently, the modal share for carpooling in Canada and the U.S. is approximately 8 to 11%, respectively (Chan & Shaheen, 2012).

Table 2.1: Transportation to Work 1980-2011: Drove alone vs. car pooled and transit

Means of Transportation to Work, 1980, 1990, 2000, and 2011

Means of transportation	1980 Census Number of workers		1990 Census Number of workers		2000 Census Number of workers		2011 ACS Number of workers	
	1,000s	Share	1,000s	Share	1,000s	Share	1,000s	Share
Private vehicle	81,258	84.1%	99,593	86.5%	112,736	87.9%	120,316	86.3%
Drove alone	*62,193*	*64.4%*	*84,215*	*73.2%*	*97,102*	*75.7%*	*106,139*	*76.1%*
Car pooled	*19,065*	*19.7%*	*15,378*	*13.4%*	*15,635*	*12.2%*	*14,177*	*10.2%*
Public transport	*6,175*	*6.4%*	*6.070*	*5.3%*	*6,068*	*4.7%*	*6,914*	*5.0%*

Sources: Davis, et al, 2013, p. 8-20.

1.1 Distinguishing dynamic ridesharing services from non-dynamic services.

DRS differs from regular ridesharing, also known as carpooling, in that it is an ad-hoc service arranging single shared rides on short notice (Amey, Attanucci, & Mishalani, 2011). Regular ridesharing has had a primarily temporal dependence on commuting where participants agree to a recurring long-term schedule of planned shared rides. Regular ridesharing, or carpooling, may be organized by an employer or governmental agency who supply a match-list for participants to arrange rides with common origins and destinations. This can be done in some conventional ways such providing lists of potential participants on a website with contact information or government sponsored call centers initiating matches via telephone. Informal carpooling can also be initiated by co-workers making arrangements for rides based on current mutual needs. In the 1990s, carpooling was also a component of the Clean Air Act of 1990 that was intended to reduce vehicle air emissions.

There is another variation of informal carpooling known as casual carpooling or *slugging*, which is an ad-hoc form of rideshare initiated by commuters at Park and Rides or large employment centers such as the Pentagon in the northern Virginia suburbs of Washington, DC. Slugging is motivated by a commuter's incentive to use the faster moving High Occupancy Vehicle lanes or to reduce daily costs of tolls and fuel. Slugging is effective in reducing the number of vehicles per lane during peak demand periods (Ma & Wolfson, 2013). Slugging differs from DRS in that the participants meet in-person and make informal arrangements for fuel and toll payments.

Finally, DRS should not be confused with car-sharing organizations that provide members access to shared vehicles via a reservation system similar to the car rental company model (Shaheen, Cohen, & Chung, 2009). Car-sharing companies like Zipcar and Hertz on Demand differ from dynamic ridesharing in that users are committed to a specific rental period, and it does not discouraged single-occupancy vehicle (SOV) use (Figure 1.1). Car-sharing has had some success as Cervero, Golub, and Nee (2007) noted, that 30 percent of households participating in a car-sharing program either avoided or postponed car ownership and used other modes more often such as transit, bicycling, and walking.

Figure 1.1: **Zipcar, a subsidiary of Avis Car Rental Company, is a car-sharing company that allows members to pay a fee for access to various vehicles, depending on the driver's needs. (Source: John DiGianni)**

1.2 Background

Carpooling has been part of the transportation planner's toolbox since the mid-twentieth century, however, it has received new attention due to a convergence with advanced information and communication technologies (ICTs) over the last two decades (Siddiqi & Buliung, 2013). High-speed broad band access to the Internet offering real-time delivery of information over location-aware mobile devices are the enabling factors that are defining DRS as a new paradigm for sustainable transportation. A paradigm shift can be seen in the roles of the different stakeholders who are creating a convergence between ICTs, automobile manufacturers, and software developers along with end user confidence all of which are leading to the current proliferation of DRS providers (Siddiqi & Buliung, 2013). Automobile companies have already indicated the potential economic harm that DRS presents to the industry. However, some companies such as Daimler have been very supportive of DRS research (Ecosummit TV, 2014).

DRS is linked to carpooling in that it matches drivers with riders while reducing the use of single-occupant vehicles (SOVs). In a DRS scenario, however, non-recurring trips are arranged between participants in real-time using an Android or Apple smartphone (Figure 1.2) or social media website such as Facebook (Figure 1.3) on a per-trip basis (Levofsky & Greenberg, 2001). Both riders and drivers must be registered with a matching provider via a software application on their smartphone or through a social media website. When a request for a ride is made a database is searched for potential drivers and riders using high-dimensional matching that analyzes multiple parameters such as proximity, pricing, and trust and reputation systems (Furuhata, et al., 2013).

Figure 1.2: **Left, Android 4.3 home screen. Right, Apple iOS7 home screen. (Source: Author)**

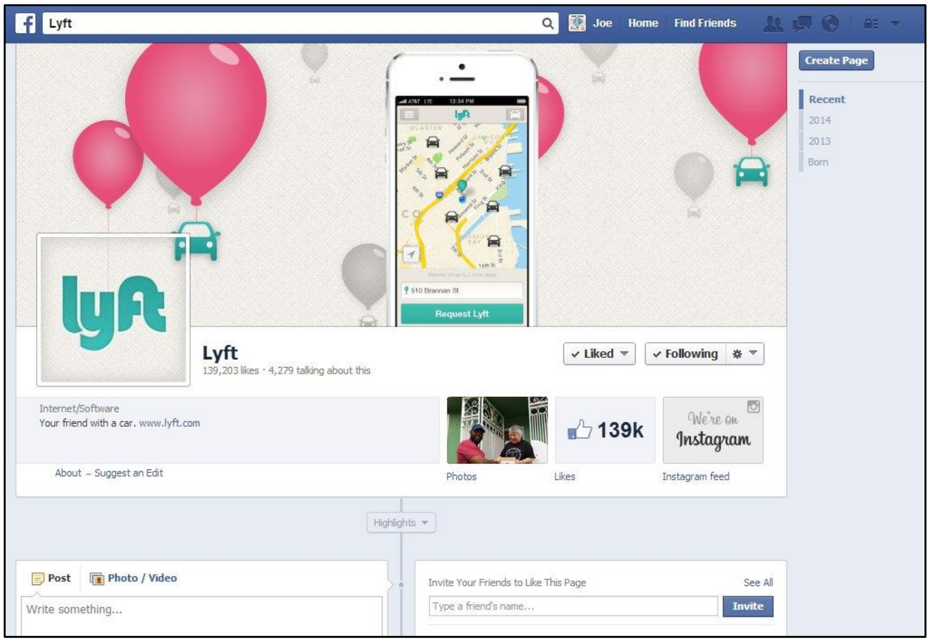

***Figure 1.3* : Facebook webpage for a DRS service.(Source: Lyft, 2014)**

The ICT convergence has enabled much of the recent success of DRS, however, lingering challenges regarding personal safety have also been addressed. For example, the use of trust and reputation systems, another unique feature of DRS is similar to user rating systems employed by online retailers eBay and Amazon. In a DRS arranged ride, trust and reputation systems are used by both the driver and the rider who must rate the experience at the end of the transaction (Furuhata, et al., 2013). Other layers of added security include mandatory criminal and motor vehicle background checking conducted by the match provider that solves some of the traditional carpooling resistance that riders have to sharing trips with strangers. Furthermore, match providers make available liability insurance to lessen participant anxiety over any legal issues that might arise in the event of an accident (Figure 1.4).

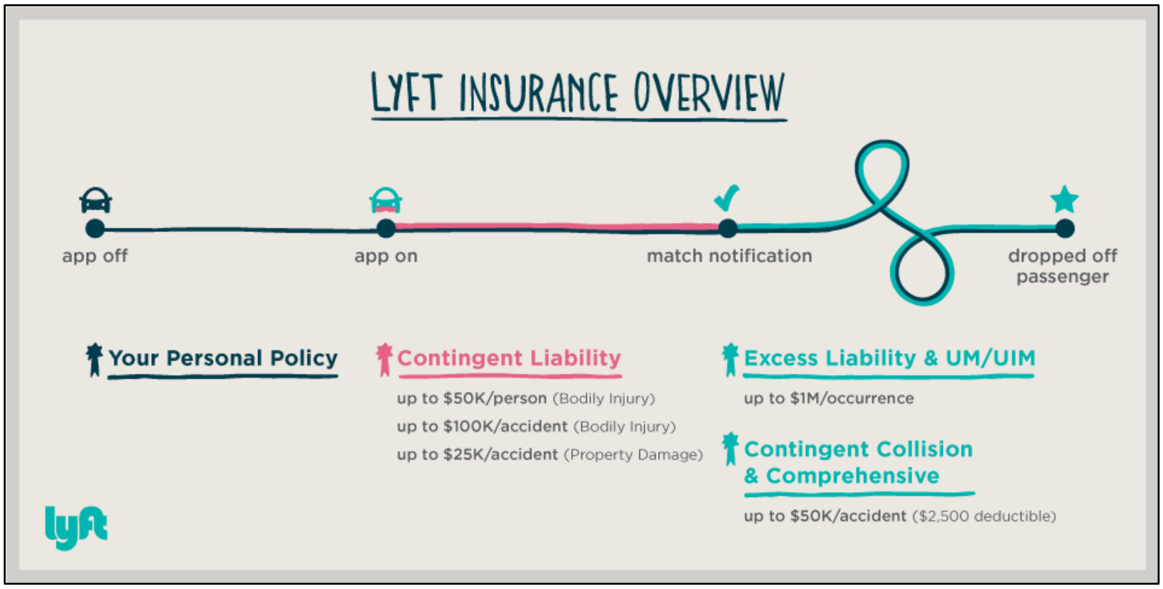

Figure 1.4: **Insurance policy infographic (screen capture) for DRS provider Lyft. (Source: Lyft, 2014)**

It has become increasingly difficult to ignore the transportation sector's contribution to Greenhouse Gas (GHG) emissions, lost economic productivity due to traffic congestion, and dependency on imported oil. Despite public policy promoting mass transit and traditional carpooling most programs have failed to achieve a substantial modal share especially in low-density automobile-oriented urban areas (Levofsy & Greenberg, 2001). Among the major energy consuming sectors, transportation's share of total CO_2 emissions is largest at 31.7% (Table 1.2) (Davis, et al., pp. 11-5, 2013). Strategies to reduce transportation's emissions are most often focused on regulating travel demand which at a rudimentary level are the decisions made regarding when and how to reach places such as centers of employment, entertainment, etc. (Cervero & Kockelman, 1997).

Table 1.2: Transportation's share of total GHG emissions.

Total U.S. Greenhouse Emissions by End-Use Sector, 2011

(million metric tons carbon dioxide equivalent)

	Carbon dioxide	Methane	Nitrous oxide	Hydrofluro-carbons, perfluro-carbons, sulfur hexafluoride	Total greenhouse gas emissions
Residential	1,131.8	3.7	9.2	25.2	1,169.9
Commercial	966.2	121.9	13.5	29.4	1,131.0
Agricultural	123.7	210.6	278.1	0.2	612.6
Industrial	1,575.2	249.6	39.1	33.3	1,897.2
Transportation	1,758.3	1.4	16.9	57.1	1,833.7
Transportation share of total	31.7%	0.2%	4.7%	39.3%	27.6%
Total greenhouse gas emissions	5,555.2	587.2	356.8	145.2	6,644.4

Source: Davis, et al, 2013, p. 11-5.

Transportation demand management (TDM) policies in the U.S. have traditionally involved strategies aimed at reducing such demand by inducing drivers to shift from SOVs to high-occupancy modes such as carpooling and mass transit (Black & Schreffler, 2010). Other recent strategies have included bike-sharing, such as the Citi Bike program, a privately managed public bicycle sharing program in New York (Citi Bike, 2015) (Figure 1.5). Citi Bike users purchase passes from a street pay station that deducts fees electronically based on the period of use.

DRS in practice reduces the number of vehicles per lane of roadway, thus it qualifies as a TDM strategy aimed at reducing oil dependency, consumption, and traffic congestion. All are promising goals. However, the degree of these benefits is still unclear and requires further research (Chan & Shaheen, 2012).

Figure 1.5: **A Citi Bike station in Manhattan. (Source: John DiGianni)**

Saddiqi and Buliung (2013) examined the historical progress of DRS from a technological perspective highlighting the strengths and weaknesses of ICTs from the period of the 1970s oil crises which relied on early Bulletin Board Systems then available only at universities and large governmental agencies, into the present mass adoption of smartphones beginning in the late 2000s with devices like the Blackberry, iPhone, and Android. Surveys such as those conducted by Buliung, Bui, & Lanyon (2012) have shown that the temporal regularity of commuting, i.e. journey-to-work, is influential in the successful formation of carpooling programs. It is often the work commute that receives the most focus for this very reason, however, recent evidence suggests that the highest person miles of travel (PMT) have shifted from commuting to personal trips, e.g. shopping, visiting, entertainment, etc. (NHTS, 2009). While there has been much research on commuting and carpooling, there has been relatively little empirical research on DRS other than anecdotal evidence suggesting it often used outside of the work trip.

Chan & Shaheen (2012) provided a synopsis of ridesharing's history divided into five key phases: (1) World War II car-sharing clubs intended to conserve resources, e.g. rubber, fuel, steel, etc. (1942-45); (2) reactions to geopolitical events involving the manipulation of oil markets, i.e. OPEC oil embargo, (1970s to 1980); (3) early employer-based ridesharing schemes focused on air quality and traffic reduction that relied on telephone-based matching and employer incentives (1980-1997); (4) reliable ridesharing systems that used early ICTs to provide matching services typically via websites or traveler telephone information services, e.g. 511 phone travel information service (1999-2004); (5) Internet-enabled and location-aware real-time ridesharing based on incentives held out by sustainable urban transportation initiatives (2004 to present).

From this overview one sees that ridesharing plays an important role in addressing societal issues. Hence it is important to seize on the current renewed interest in the topic for further study. To date, there has been little agreement on what constitutes an effective

DRS program. The chief aim of this study is to identify the benefits and motivating factors that attract users and, more importantly, characteristics for early adopters of DRS.

1.3 How dynamic ridesharing works- a primer.

Both drivers and passengers may initiate DRS by signing in through their Facebook account or by downloading an application to their smartphone. Either of the above access methods creates an account providing an interface where users post their availability as drivers or passengers. In the case of drivers, the availability of seats in his or her vehicle is posted along with a face picture and information identifying the vehicle (e.g., a full image and license plate number). Riders open the application on their smartphones and begin keying in a request for a vehicle via the software's interface. Global Positioning Systems (GPS) built into the hardware and software of the smartphone make the device location-aware, thus enabling real-time matching of participants based on their proximity to each other. At this point, the service attempts to match the rider to an available driver using an algorithm that accounts for distance and time to the pick-up and drop-off points. The passenger sees on his or her smartphone screen an estimated pick-up time as well as the fare for the ride. Payment is not handled in-person but is processed through the smartphone's software application that contains the passenger's credit card information. At the completion of the trip, the application requests the passenger to provide a rating of the driver and overall service. Likewise, the driver is also given an opportunity to rate the passenger on his or her device. A payment for service is deducted from the rider's credit card with generally 80% of the fare going to the driver and 20% to the matching provider (Lyft, 2014).

1.4 Tying dynamic ridesharing to Environmental Management

The present transportation system's capacity is not being utilized efficiently. The phrase "transportation system" can mean many things, e.g. roads for private vehicles, public transport vehicles (buses, vans, jitneys), heavy commuter rail, urban metros, ferries, lanes and infrastructure dedicated bicycles, and more.

According to the U.S. Census Bureau's five year estimate (2009 to 2013), 106.7 million workers drove alone to work in a car, truck, or van (U.S. Census, 2015). Assuming the average vehicle holds 5 passengers, these workers took with them the potential to transport, 426.9 million people in their vehicle's empty seats. That's more than the estimated 2015 U.S. population of 320 million people.

Seats that can be filled reduce road capacity, an environmentally beneficial condition that can lead to: reduced traffic congestion, reduction of transportation sector's impact on the environment, free flowing roadways without further need for infrastructure investments, and increased work productivity.

1.5 Research Objectives

The overall structure of the study will take the form of four chapters, including this introduction, with the chief aim of contributing new research for the transportation planning profession's understanding of DRS as a TDM method to reduce SOV use. This study will examine three key research objectives:

1. Exploration and assessment of the directions that DRS has taken, and its potential as a disrupting innovation to change the current urban transportation system both nationally and globally.
2. A demographic examination of a sample of U.S. DRS users to understand who are the early adopter consumers of DRS.
3. A qualitative assessment of leading DRS services in two premier cities, San Francisco and New York, to compare and contrast issues. A chronology of legal and administrative issues was used to determine the similarities and difference of DRS development in each city.

Each research objectives will be explained in detail in the remainder of this section.

1.6 Organization of Thesis

Chapter 2. The objective of the first study examined the current state and direction of DRS. The study introduces DRS in a historical context. DRS is explained within the present-day context of SOV-driven automobility. Early car-sharing programs are described, and then compared and contrasted with DRS to learn similarities and differences. A history and description of DRS follows, with an explanation of how it breaks with traditional transportation management strategies. The break with transportation planning is witness by the convergence of DRS ICT. In the past, transportation engineers and planners formulated solutions to mobility problems within their specific disciplines. DRS represents a break with that model.

The first study is titled "Explorations of the Current State and Directions in the Emerging Field of Dynamic Ridesharing Platforms". The study was submitted and published in the *Middle States Geographer*, Volume 47, 2014. The *Middle States Geographer* is an official published journal of the Middle States Division of the Association of American Geographers.

Chapter 3. The objective of the second study will be to explore the demographic characteristics of the users of DRS. The approach to empirical research adopted for this study will be quantitative based on a structured survey administered over the Internet to a target audience of dynamic rideshare users. See the Appendix A for a reproduction of the survey approved by the Montclair State University Institutional Research Board. The target audience was a sample of 300 participants with a balance of male/female responses. An online survey was administered, by SurveyMonkey, an Internet platform that provides audiences and analysis of responses (SurveyMonkey, 2015). The respondents were randomly chosen from all regions of the United States. Descriptive statistics were used to explore user-driven motivations to use DRS, which was aimed at providing opportunities for system improvements and expansion (Zmud & Rojo, 2013).

Technology-enabled DRS is the newest emerging innovation being adopted by consumers, however little known about this evolving transportation mode. By examining a segment of the population who have adopted DRS, we hope to understand if the new technology can provide alternatives to the predicament of SOV use. The purpose of this study was to describe who the users of DRS are in urban areas and explain how they came to choose this mode over other more established modes. The study was largely descriptive in nature.

Chapter 4. The third research objective of this study will be a qualitative assessment of the features of DRS in urban areas in order to compare and contrast features of each application on the current market. DRS companies are emerging quickly driven by technology that we have not had time to assess. Despite recent success, questions have been raised about the viability of DRS in many cities due to economic and political push-back from traditional transportation companies such as taxis and airport limousine services. Progressive states such as California have already made legal rulings on DRS services and have giving them the name transportation network companies (TNCs) to distinguish them from traditional transportation providers (Public Utilities Commission of the State of California, 2012). A comparative study will be based on how each of the leading DRS services address key issues such as optimization methods, pricing of service, minimizing costs, maximizing passengers served, and most importantly their success or failure at meeting legal challenges from traditional transportation companies as well as challenges from state and local governments who are motivated to protect the status quo .

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CHAPTER 2

Exploration of the Current State and Directions in the Emerging Field of Dynamic Ridesharing Platforms

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Abstract

Automobility has advanced since the postwar decline of public transportation and its near universal replacement by single-occupant vehicles (SOVs) throughout much of the developed economies. Even so-called “transit friendly” economies of the Global South have seen shifts in their modes of transportation to systems that are predominantly SOV-based (Cervero, 2013). Intensive infrastructure expansion within emerging economies indicates that the SOV is being adopted at a rate similar to the developed economies of one hundred years ago. Henry Ford's quote “With mobility comes freedom and progress” points to the concept that mobility becomes universally interpreted as “automobility”. Grave concern is linked to the continuation of the SOV model and its consequences for an environment taxed by an ever-expanding transportation sector. A paradigm shift, however, in the SOV-driven model, has been detected coming not from transportation but the different domains of information and communication technologies.

This review examined the current state and direction of dynamic ridesharing (DRS), an emerging technology driven by recent technology innovations over the last two decades (Siddiqi & Buliung, 2013). DRS matches drivers and riders in real-time using Internet and mobile technology, and are single-occurrence events organized on short notice (Amey, Attanucci, & Mishalani, 2011). We include a case study of DRS from its roots in San Francisco, CA. The city provides a present-day template for emerging themes when DRS is introduced into the present-day urban transportation system.

Keywords: dynamic ridesharing, mobile communications, Uber, Lyft, SideCar, taxis

2. Introduction

Apart from safety and amenity advancements, little has changed in personal mobility since the public transportation network was rendered secondary by postwar business interests. Much of that network became universally replaced with single occupancy vehicles (SOVs) (Snell,1995). Automobility focused on technological advancements in amenities, fuel economy, and safety improvements and has been pervasive even within the so-called "transit friendly" developing countries of the Global South (Cervero, 2013). Intensive highway infrastructure expansion among the rising economies has signaled their intention to replicate the developed world's SOV model based on Henry Ford's motto “With mobility comes freedom and progress".

The year 2015 marks the 70th anniversary of a period of vast economic and social upheaval following World War Two. Change was stimulated by the mass migration of middle-income families from the central cities to the less expensive land of the suburbs and concomitant monumental investments in infrastructure and highways. During the automobility era, private vehicle ownership has been encouraged and welcomed as a facilitator of opportunities for those once confined to housing within walking distance to the nearest transit stop (Liepmann, 1944). This freedom has come at a cost in terms of global environmental climate change enabled partly by rising vehicle emissions, squandered resources, and productivity lost to SOVs idling in traffic. Among the major energy consuming sectors, transportation's share of total CO2 emissions is largest at 32.9% (Davis, Diegel, & Boundy, 2014, p. 11-15).

The information and communication revolution in technology has changed many aspects of society, particularly in the retail and financial sectors. Information technology has been slow in adapting to transportation systems. The arrival of Big Data, the massive volume of both structured and unstructured information collected by ubiquitous sensors as well as social media websites and global-positioning-system-enabled (GPS) mobile devices, has at last come to transportation (Miller, 2013). A paradigm shift in automobility in the developed and developing economies is still in its initial stages, but it is rapidly altering common perceptions of private vehicle ownership and use.

A major activity behind this paradigm shift is a variant of carpooling known as dynamic ridesharing (DRS). DRS is an emerging method of personal mobility based on the traditional concept of ridesharing. DRS matches drivers with riders in real-time using online technology platforms (Agatz, Erera, Savelsberg, & Wang, 2012). The platforms provide matching services via smartphone applications that use information, communication, and location-aware technologies to match drivers with riders in real-time. Drivers do not work for a technology company providing matching services, but are instead independent contractors providing their vehicles to transport passengers (Hubpages, 2014). The DRS platforms also offer a method of payment using a smartphone, and in most cases peripheral services such as liability insurance and background investigation of drivers (made available to quell concerns about personal safety). The DRS companies earn income using a business model based on transactions called an administrative fee that is typically 20% of the charge for the ride (Hubpages, 2014). The remaining 80 %of the fare is deposited electronically in a bank account designated by the driver. The DRS platform sets the charge for the ride based on factors such as distance and whether the ride occurs during peak or off-peak hours.

DRS differs from traditional ridesharing since matches between drivers and riders are arranged in real-time using mobile technology, are single-occurrence events and organized on short notice usually within minutes before a ride (Amey, Attanucci, & Mishalani, 2011). Traditional ridesharing, such as carpools and pre-arranged shared vehicles, continue to be part of the transportation planner's toolbox. However, the toolbox has expanded with recent advancements in information and telecommunication technologies (ICT) that have allowed the evolution of DRS (Figure 2.1). DRS represents a break with tradition in its lack of connection to the major regulation, transportation planning, or engineering disciplines. Contemporary transportation demand management (TDM) strategies designed to reduce traffic demand and SOV usage were policies developed by transportation professionals such as traffic engineers and transportation planner. DRS has similarly desired outcomes; however, it was conceived out of the entirely different domain of information technology.

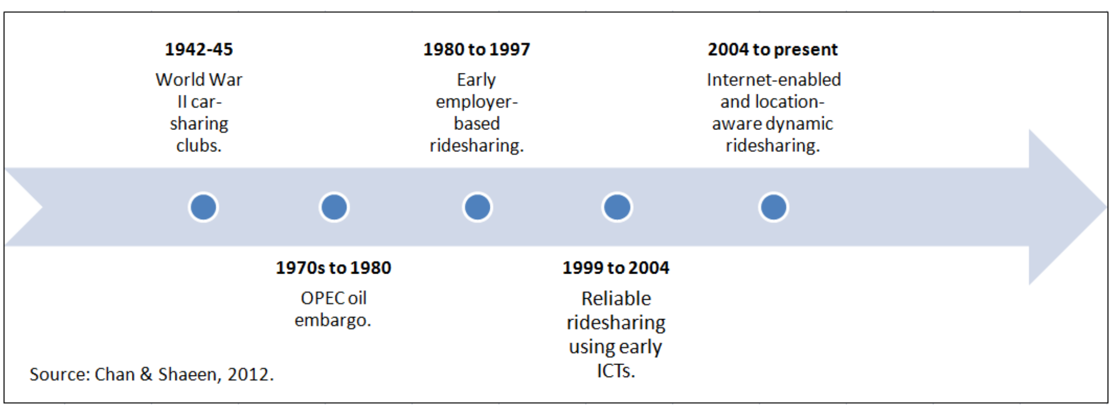

Figure 2.1: **The evolution of ridesharing.**

DRS proliferation has followed a predictable pattern established in San Francisco, CA, its city of origination. That pattern is one of a disruptive innovation (Christensen, 2003), occupying the newer value network of smartphone users, and ever poised to invade the older value network of the taxi and limousine industry. Consequently, DRS has pushed hard on the older taxi and limousine industry to the point where competitors are attempting to fend off market erosion with similar technology with hopes of surviving the current disruption (Christensen, 2003). Renewed interest in the concept of ridesharing must be understood not as a sustaining innovation but as disruptive, with potential to change all existing for-hire car markets. DRS focuses on the convergence between information and communication technologies, GPS-enabled internet and mobile devices (i.e., smartphones), and represents a new paradigm in transportation planning (Siddiqi & Buliung, 2013).

2.1 Background

This review examined the emerging themes and changing aspects of the new DRS technology into the classic urban transportation system. It focused on the current state of the top three DRS platforms: UberX, Lyft, and SideCar. The platforms are the companies creating the software that operates on smartphones and websites, and allows drivers and riders to be matched in real-time. San Francisco was chosen as a case study because it the origination point of ICT-enabled DRS and can be used to explore general directions that DRS services take once they enter a market. San Francisco possessed a unique history regarding the traditional taxi industry. Despite its unique underlying history, San Francisco provides a basic formula for DRS adoption in cities across the world. On a rudimentary level, each DRS platform offers a service matching riders with drivers using similar software and hardware. Additionally, each DRS service has similar policies for transaction processing, providing automobile insurance, and plans for future expansion. Variation occurs where each platform offers its own distinct brand of ridesharing that is often reflected in the social media of individual offerings. Although there is an apparent variation among cities and DRS platforms, there is a demonstrable pattern of DRS adoption that follows the San Francisco case history.

The technology companies responsible for the development of smartphone applications are at the heart of DRS. The leading platforms, UberX, Lyft, and SideCar, each represents a prominent position in the current state of DRS. Uber is the largest service offering the most choices in ridesharing spanning from luxury livery vehicles to basic sedans. In all cases vehicles are driver-owned independent contractors who set their own work schedules. Lyft is the next largest platform the primary competitor of Uber. In order to compete directly with Uber, Lyft has been branching into specialty services such as Lyft SUV, a service that provides larger vehicles, and Lyft Line, a service that uses a program to match multiple riders in a single vehicle along an optimized route (Lyft, 2015). In third position, SideCar competes by offering fares lower than the two giants. The DRS transport mode is developing quickly due to competition among the platforms and the rapidly changing nature of enabling technologies. Hence, any thorough cataloging of DRS platforms at this time will likely result in an outdated list (Deakin, Frick, & Shivley, 2011).

2.2 The Dynamic Ridesharing Platforms

The sphere of DRS platforms is comprised of startups that have risen and fallen quickly due to the rapidly evolving nature of their technology. Additionally, the nascent business model of DRS is still unrecognized by many regulators at state and municipal levels. (Begley, 2014). Additional background on Uber, the parent of UberX was provided to give context. Background was also provided for Zimride, the earlier iteration of Lyft. The following sections give a brief overview of the histories and business models of the prominent platforms, Uber/UberX, Lyft, and SideCar, as of 2015.

2.2.1 Uber and UberX

The breakthrough enabling technology needed to make ridesharing real-time would be wedded to DRS at the 2008 Le Web Conference in Paris, a venue for European entrepreneurs. Startup technologists Garret Camp and Travis Kalanick, met at the conference and formed what was to become Uber, the present day behemoth of DRS platforms. Both had recently completed start up deals and were reflecting on what could be the next major disruptive innovation from Silicon Valley. Camp had suggested dealing with the well-known problem of requesting a taxi in San Francisco. A victim of mid-twentieth century deregulation and re-regulation, the taxi industry in San Francisco had become synonymous with some of the most unpleasant aspects of that city's life (Newsham, 2000). Camp and Kalanick devised a program, initially for their exclusive use that would circumvent the taxi problem by using smartphones. An app on the iPhone was developed to split the cost of a professional driver and a luxury black car to get around San Francisco on-demand (Arrington, 2010). Upon returning to San Francisco, the two began what could be called a "limo timeshare." They split the cost of a Mercedes S Class limousine, a driver, and parking space in a city garage. Either could use the app on his iPhone to summon the shared-limo without resorting to taxis to get around San

Francisco. The developers soon realized that anyone with access to a smartphone and appropriate software could use such a system to circumvent the historical problem of getting around San Francisco by taxi. Hence, the final piece of the DRS puzzle, developing a mobile device app, was developed by Camp in March of 2009. At the same time, Kalanick prepared a prototype of the project that was tested in New York using several cars in January, 2010.

Uber was officially launched as UberCab on May 31, 2010 on iPhone and Android mobile devices in San Francisco. At its inception, UberCab offered only full-size luxury vehicles based on the company's original prototype that reflected private black luxury car services offered in Lower Manhattan. The name "UberCab" was shortly changed to "UberBlack" to conform to its black luxury car image. In December 2010, Kalanick became CEO of Uber (Uber Blog, 2010). The management change reflected a strategic transition from the successful launch to long term disruption strategy based on Kalanick's philosophy of DRS-driven industry change. In 2012, Kalanick threatened industry disruption in the form a full attack on the local taxi and car-for-hire industry with the launch of UberX, the platform's program of smaller non-luxury privately owned vehicles driven by non-professional drivers, and at prices competitive with regular city taxis (Flegenheimer, 2014). As will be shown in the case of San Francisco, industry disruption can be positive and bring improvements to customers in a region where taxis service had become all but dysfunctional. The ease with which UberX had recruited drivers and immediately placed them on the street transporting passengers has been phenomenal and well documented. The lack of traditional car-for-hire regulatory restrictions has made UberX more accessible to both drivers and riders with its ease of driver enrollment and simplicity of passengers using smartphones to summon a ride. Unlike Uber Black, the smartphone application that summons a black luxury car at premium cost, UberX meets the more precise definition of DRS which is the short notice matching of riders and drivers in average, privately owned vehicles. Hence, Kalanick's UberX model offered more potential to disrupt the taxi industry with its simplified model (Brustein, 2013).

2.2.2 Lyft

In 2007, Logan Green, a recent University of California, Santa Barbara graduate, developed a web-based DRS service called Zimride.com to make trips to see friends in California (Bell, 2007). The use of websites on the Internet to match riders with drivers was not new in 2007, dating back as far back as the 1990s (Dailey, Loseff, & Meyers, 1999). A fundamental change came when Facebook released its application programming interface (API) to third-party developers. Green used this opportunity to incorporate the trust and reputation capabilities of Facebook that would make ride-matching closer to present-day DRS (Masabumi, et al. 2013). Leveraging the social networking capabilities of the website Facebook added two elements that were missing from ride-matching: overcoming the initial fear of getting into a vehicle with a total stranger and creating the critical mass of users necessary to provide regular and complete round-trip service (Bell, 2007).

Later in 2007, Green met John Zimmer, an analyst at Lehman Brothers in New York. Zimmer’s graduate studies at Cornell University included transportation issues with a particular emphasis on solving the problem of underutilized road capacity, estimated to be about 80% daily. Zimmer saw this as an opportunity to fill those empty seats and make efficient use of road capacity. By the time of Lyft's launch in San Francisco during the summer of 2012, about 2000 seats per month were being filled on rides between San Francisco and Los Angeles for about $35.00 each way (Gustin, 2012). As CEO for Lyft, Zimmer has been instrumental in developing the platform's core philosophies. These beliefs included using enabling technology to change structural inefficiencies in transportation (Gustin, 2012) and focus on community-building to bring people together (Olanoff, 2012).

2.2.3 SideCar

SideCar, a DRS platform launched in San Francisco in June 2012, is third ranked among the national platforms operating today. Initially, SideCar differentiated itself in how it priced rides. SideCar began an innovative policy where the passenger set the price of the ride, which the company called donations, rather than fares. Instead of choosing a set price, the app asks the passenger to decide how much he/she feels the ride is worth. (Brustein, 2013). The passenger's price was honored as a valid fare regardless of whether it covered the cost of the driver's time and/or vehicle operation. The "donation" policy changed in 2013 and riders were required to pay minimum fares. This decision was made to compete with Uber and Lyft and encourage SideCar drivers to drive more regularly (Rodriguez, 2013). Like the two larger platforms, SideCar incorporates trust and reputation systems that allow drivers and riders to rate each other. Trust and reputation systems are an integral part of the sharing economy and in the case of DRS have a direct role in the operation of app-enabled ridesharing programs (Miller, 2013).

2.3 Existential Issues Facing the DRS Platforms

2.3.1 Insurance and DRS Platforms

Automobile insurance is handled similarly by each DRS service and is often a function of the state in which the platform operates. Platforms claim their insurance packages cover occupants of vehicles and injuries to persons and property outside of vehicles in the event of an accident during the entire DRS process. Platform-paid coverage generally begins from the moment the app is opened until it is shut off. Specifics depend on the platform, the jurisdiction being served, and any DRS-specific regulation that has been put in place at the state or municipal level. For example, Lyft states in its insurance overview that a driver has contingent liability insurance while his/her smartphone app is on waiting for a ride match. During the time defined by the California Public Utilities Commission (CPUC) as Period 1, up to $50,000 coverage per person is offered for bodily injury, up to $100,000 per accident for bodily injury, and up to $25,000 per accident for property damage. In addition, Lyft offers excess liability and uninsured/underinsured motorist coverage up to $1,000,000 per occurrence and contingent collision and comprehensive coverage of up to $50,000 per accident with a deductible of $2,500 (Lyft, 2014). UberX offers coverage in most states at levels similar to taxis and limousines in the cities of those states (Uber Blog, 2014). Sidecar's driver liability for property damage and/or bodily injuries to passengers or third parties offers coverage at $1,000,000 per occurrence and is similar to Lyft and UberX, however, additional coverage for the "app on" period is only offered for the state of Washington.

The model of regulation that has been emulated by most DRS platforms is based on a decision made by the CPUC in San Francisco on September 2013 where the name Transportation Network Company (TNC) was created to define DRS platforms that used smartphones and Internet technology to match riders with drivers (California Public Utilities Commission, 2013) (Appendix B). The CPUC also set mandatory rules on driver and criminal background searches for drivers registering with a TNC. Insurance was also made necessary by the CPUC, setting three "defined periods" to help clarify when insurance applies. Period One is "App open-waiting for match"; the driver is in his/her vehicle and turns on the app. Period Two is "Match is accepted- but the passenger is not yet picked up"; the driver is on his/her way to retrieve the passenger. Period Three is "Passenger in the vehicle and until the passenger safely exits vehicle" (Table 2.1). The CPUC wanted to make sure there were no insurance gaps when drivers were getting paid to give rides and achieved this with the legislation passed (G. Mathieux, personal communication, October 9, 2014).

Table 2.1: CPUC defined periods when TNC covers insurance.

State of mobile device		Insurance coverage based on state of mobile device	Uber (1)	UberX	Lyft	SideCar
Not logged on/not available	(app off)	Driver's personal auto insurance				
Logged on/available but not on trip	(app on)	Driver's personal auto insurance -PLUS- Contingent liability coverage (Also called "insurance gap" coverage(2)		X	X	X
Driver: - Accepts trip - During trip - Ends trip	(app on)	Commercial coverage when trip is accepted, while en route and carrying passengers, and when trip ends and passenger exits vehicle		X	X	X

1. Drivers offering rides through UberBlack, UberSUV, and UberTaxi carry commercial insurance in at least the minimum required by local regulators.
2.TNC provides contingent liability coverage if/when driver's personal auto insurer denies claim.

Controversy still exists over TNCs and their role at airports. Despite a near universal laissez-faire acceptance of TNCs throughout California's cities and the rest of the United States, airports have stood vehemently opposed to TNC operations on airport property. Their hesitancy ostensibly stems from a concern about additional traffic congestion at airports. Some TNCs, such as Wingz, circumvent the airport issue since they do not use a smartphone app, but instead accept reservations for airport pickups and drop offs through their website only. The CPUC and the City of San Francisco recognize that web-based companies such as Wingz historically had customers reserve rides via the web. Thus, they are exempt from the Period One and Period Two phases of insurance coverage. The "hybrid" web-based TNCs are required to provide coverage for defined Period Three. Defined period three is when the passenger enters the vehicle and until he/she safely exits (G. Mathieux, personal communication, October 6, 2014). Discussions to allow TNCs at airports are ongoing.

2.3.2 TNCs and the Taxi and Limousine Industry

Another major issue affecting the viability of modern DRS platforms, including those operating as TNCs, is their mixed and often contentious reception by municipalities and the taxi and limousine industry. When TNCs such as Uber, Lyft, and SideCar enter a market, municipalities find themselves in an awkward position of intermediary between the interests of influential labor and taxi industry lobbies and local citizens who see DRS as an environmentally progressive and cost effective alternative to the old taxi and limousine model. In most cases, the local taxi industry and its attendant labor groups resist the DRS platforms citing unfair advantage due to the lack of regulation. Some municipalities have raised the issue to the state level requiring a degree of regulation from the DRS platforms by classifying them as TNCs. TNC regulation typically includes mandatory motor vehicle and criminal background checks on drivers, safety inspections of vehicles, and minimal commercial insurance coverage.

DRS platforms operate in more than 90 cities in the United States. Only seven states, Delaware, Montana, Nevada, North Dakota, South Dakota, West Virginia, and Wyoming have not had a DRS platform enter any of their municipalities as of 2014. Noticeably absent from the list of DRS cities is Las Vegas, NV, a city whose taxi and limousine industry is unique. Taxi regulation in Las Vegas is by a state-appointed board of officials shielded from direct lobbying by the major TNCs (Shine, 2014). Las Vegas with its giant tourist industry, however, cannot be ignored, and how and if the TNCs manage a launch in this city can be another indication of how viable DRS is especially in cities that have strong political mechanisms in place to thwart acceptance .

The question of DRS's viability, however, seems close to being answered affirmatively as unlike Las Vegas, most municipalities have only been able to issue cease and desist orders to TNCs. Cease and desist orders are ignored summarily by the TNCs, who would rather pay fines than halt operations. Another tactic used to halt or slow down TNC market entrance is quick and temporary legislation that is contingent on a final vote off in the future. This approach often fails as well since in the interim TNCs have time to take their case to the public who is typically sympathetic. Hence, acceptance continues to evolve with all but eighteen states having some form of legislation pending (Jergler, 2014).

When a DRS platform enters a new market, it follows an established pattern based on its inception in San Francisco. At first there is intense interest by early adopters and the unemployed/underemployed who see a promising new transport mode and help to diffuse the innovation rapidly. The reaction of taxi and limousine companies to early DRS launches were initially benign. The newcomers were sometimes cast in the local press as outgrowths of the Great Recession of the late 2000s and its concomitant Sharing Economy (Fournier, et al., 2013). The DRS platforms' close association with technology was initially seen as a fad associated with young urban adults. With time and experience, however, taxi and limousine companies quickly learned that DRS platforms were well received by drivers and riders across the demographic spectrum. Current reaction to DRS arrival is now quite proactive usually beginning with press campaigns and appeals at the municipal level to reign in the unregulated competitors. Unfortunately, once the local citizens experience DRS it becomes difficult to reverse. The reason for this is the DRS platforms have been savvy in their use of promotions and media in inculcate themselves into the local culture. Also, allowing them to demonstrate their service has filled a void in many cities where clean, reliable, and pleasant taxi service has been missing.

Municipalities try to reach consensus among the DRS platforms and its constituency made up of primary stakeholders such as local citizens, labor unions, and taxi and limousine companies. Additionally, depending on the municipality, taxi medallion owners are a vocal group who stand to lose significant income. Taxi medallions are government-controlled taxi permits that increase in value based on economic regulation such as limited supply for the entire city. The provision and value of medallions become meaningless as the rate of DRS adoption increases (Badger, 2014). The concerns of medallion owners have yet to be resolved and promises to be a sticky future issue as it involves government taking or eminent domain arguments and possible compensation for the owners (PR Newswire, 2014). Further research into the status of medallions with regards to TNCs is required in order to find optimal solutions for this problem.

Cities in the United States began regulating taxi companies in the 1920s in order to deal with the chaos of independent drivers, upgrading of safety standards, and reduction of discriminatory practices (Dempsey, 1996). Part of that regulation was the institution of the medallion system. About fifty years later many taxi companies were deregulated along with other transport modes as per the business and ideological moods of that time. As will be shown in the case history of San Francisco, deregulation brought unsatisfactory results to most cities causing them to resume regulation or seek piecemeal fixes through ballot initiatives.

2.4 Case Study: Dynamic Ridesharing in San Francisco

San Francisco is often the starting point for a contemporary technology story (e.g. Apple, Hewlett Packard, Xerox, eBay, etc). Hence, it would seem logical to credit the site and situation characteristics of the San Francisco Bay Area with the origination and growth of DRS since it is one of the world’s preeminent research and development centers. Its proximity to major research universities and the technopole of Silicon Valley is credited with the origination of many elements of DRS technology. However, it will be shown that fundamental urban transportation issues lying outside San Francisco’s role as technopole were in place several decades earlier (Castells, Hall, 1994). Dysfunctional management of the region's taxi industry forced innovation onto this, the first of the DRS cities. An environment for reform within the taxi industry was already in place before DRS arrived in the Bay Area. And when it did arrive its success was notable. San Franciscans tend to be early innovation adopters, and their adoption of DRS was no exception as it filled a need for service in a city notable for its poor deployment of taxis. To understand the origination of ICT-enabled DRS in the Bay area, reflection on the last 35 years of attempted reform of the taxi industry in San Francisco will be instructive.

2.4.1 Background

In 1978, perceptions of unfairness and corruption within the taxi industry of San Francisco led to ballot initiative Proposition K (Newsham, 2000). Proposition K called for a system using taxi medallions as operating permits, to be issued by the City of San Francisco to persons paying an annual fee (San Francisco Municipal Transportation Agency, 2014). Persons possessing medallions are not a driver, but rather owners of medallions, who lease it to experienced taxi drivers in order to generate income. Under Proposition K, the city placed a limit on the number of medallions it authorized. By 2009, the next year of significant regulatory reform, the limit on the number of medallions authorized was 1,500 for a city of more than 800,000 people. The 1,500 medallion-limit represented a gradual increase over several decades intended to keep pace with demand. Suppressing the medallion limit, however, proved to be one of the contributing factors in public complaints regarding the difficulty of ordering a taxi (Said, 2014).

The 1978 system was designed to prevent speculators from bidding up the price of permits by awarding medallions only to individuals who would rent taxis from established companies at a set fee per shift. However, after several decades it was apparent that this system was not optimal for deployment of taxis throughout the city (Newsham, 2000). An attempt to reform Proposition K led to a successful 2007 vote on Proposition A giving the San Francisco Board of Supervisors the option of transferring regulatory jurisdiction from the Taxi Commission to the San Francisco Municipal Transportation Agency (SFMTA) (San Francisco Municipal Transportation Agency, 2014). In March, 2009, the Board of Supervisors exercised the option, and the SFMTA added the Taxi Commission to a consolidation with the San Francisco Municipal Railway and the Department of Parking and Traffic. Proposition A's significance to the taxi industry was that by placing the Taxi Commission under the auspices of the SFMTA, reforming Proposition K could be realized. The transfer of jurisdiction to the SFMTA also brought retirement and medical benefits to career taxi drivers. In the past, low incomes and meager benefits precluded a social safety net despite the many years of service per average driver (Lam, et al., 2006).

Since 1978 taxi drivers have been operating as independent contractors of the established taxi companies, e.g. Yellow Cab. Independent contractor status had worked to the benefit of the taxi companies that were insured income from the leasing of medallion-linked vehicles to drivers regardless of how often they were used during a shift. Companies also benefitted from the independent contractor relationship with drivers having been relieved of paying disability and social security taxes as well as being shielded from the threat of unionization (Newsham, 2000). Many drivers approved of the independent contractor status seeing it as a benefit freeing them from direct supervision and granting the ability to set one's work schedule (Newsham, 2000).

Unfortunately, passengers suffered most from this system. Upon examination of the 1978 and 2007 rules and regulation, passengers in San Francisco are never guaranteed service when they request a taxi. The entire system is skewed to the medallion and taxi company owners who earn set fees from drivers regardless of the hours and amount of passengers handled in a work shift. For example, when a request for a ride is transmitted to a particular taxi it is broadcast to all available drivers of that company, regardless of distance or whether their vehicle is occupied with a passenger. One hopes the request will be heard by drivers who are roaming and waiting for passengers. Ironically, this is the primary dysfunction of the system because drivers are operating independently and are under no obligation to accept a call for a ride. An available driver close by to the potential rider might be ending his/her shift and will opt to leave the request open where it may or may not be accepted by drivers who are farther away.

Thus, passengers in San Francisco had been deprived of reliable taxi service for many decades despite attempted ballot initiatives that were really aimed at reforms designed to favor medallion and taxi company owners. Hence, the San Francisco taxi problem sets the stage for the DRS innovators who understood the problem and applied the enabling technologies that would fill a void and bring reliable taxi service to passengers.

2.4.2 The Launch and Operation of Dynamic Ridesharing in San Francisco

ICT-enabled DRS was launched first in San Francisco, a city in need of taxi reform and possessing the requisite engineering and financial talent requiring a successful operation. Both major DRS providers, Uber and Lyft, launched service in San Francisco at approximately the same time. Concurrent with the launches of Uber and an Lyft, San Francisco voters debated and eventually passed Proposition A, the law that would give the taxi industry yet another chance at reform. Ironically, as Proposition A was being voted into law a nascent DRS industry was beginning with a positive public reception. Other DRS services entered the San Francisco market encouraged by the success of Uber, Lyft, and SideCar.

In the wake of the successful 2013 CPUC ruling in San Francisco, incidents have occurred which continue to test TNCs. For example, a few months after the CPUC made carrying insurance mandatory for each DRS, a six-year-old girl was struck and killed at a San Francisco intersection by an UberX driver on the evening of December 31, 2013 (Melendez, 2014). The UberX driver had been picking up and dropping off passengers that evening using the UberX app on his smartphone. Under the CPUC ruling Uber must cover both the driver and his passengers with $1 million liability insurance, however, Uber contends that coverage is only in effect while drivers are transporting riders with the app on (Table 2.1). According to Uber, when the pedestrian was struck, the driver did not have a passenger in his car and was not on his way to pick up passengers, thus he was not providing services to Uber at the time of the accident (Melendez, 2013). The case is still pending with both Uber and the driver fighting a wrongful death lawsuit filed against each of them (Williams & Alexander, 2014). The victim's lawyer stated that if a device such as a smartphone is turned on waiting for ride requests, in essence the driver is providing TNC service. Uber contends that although the device was turned on, it was only displaying a GPS map, and not information on potential rides.

The case of the six-year-old accident victim is being watched carefully as there is hope it will answer questions to some of the vagaries regarding insurance and TNCs. The CPUC ruling in 2013 states that the TNC coverers drivers who use their app to engage in sharing for up to $1 to $1.5 million in liability insurance once the passenger is in the car. The accident involving the child raises the question of whose insurance covers an accident. If it is not Uber's insurance providing coverage then is it the driver's personal insurance since he/she was not transporting passengers. At present, insurers offering personal automobile insurance view any conveyance for pay as a commercial use which would void a drivers insurance. Insurance providers are becoming increasingly aware of the proliferation of DRS platforms and warn that they will not honor policies of drivers using DRS apps (Property Casualty Insurers Association of America, 2014).

2.5 Conclusions

DRS is evolving quickly, and it is still too early to understand the impact of its disruption to the car-for-hire industry, transportation in general, and the physical environment. As a transportation demand management strategy, DRS promises to fill the unused seats in SOVs and by doing so increase lane capacity and level of service (Levosky & Greenberg, 2001). Its evolution from Internet to smartphone-based applications has been instrumental in its current successful proliferation throughout the United States and cities globally. Two fundamental issues, however, threaten DRS in its current smartphone-based iteration. Although much has already been worked out between the TNCs and insurance providers regarding the *insurance gap*, the time when a driver has his/her app on and is waiting for a ride match, questions still remain and are being addressed state-by-state. Apart from insurance, the other issue threatening DRS is its coexistence with local taxi and limousine companies. On this issue, stakeholders are divided three ways, with municipalities playing a mediator role attempting to bring consensus to all parties (Anderson, 2014).

If left unanswered, questions on insurance will discourage participants, particularly drivers who will expose themselves to legal and financial tribulations. As of 2014, TNC drivers have sufficient coverage, according to the DRS platforms discussed in this study. Drivers are still expected to carry personal automobile insurance which is supposed to cover all situations, including when they are driving for a TNC with their app off (Table 2.1). Unfortunately, personal insurers cancel their policies when they discover that the driver has been using the vehicle as an independent contractor for a TNC. The solution insurers and TNCs are currently working toward is affordable commercial insurance for casual DRS drivers with details yet to be determined (Property Casualty Insurers Association of America, 2014).

The adversarial relationship between the DRS platforms and the taxi and limousine industry threatens the continued evolution of platforms into regulated TNCs capable of providing inexpensive and reliable service. If the taxi industry prevails in restricting the number of vehicles a TNC is allowed to operate in each municipality, DRS will be nothing more than an alternative mode of transportation. The promise of reducing urban traffic and the subsequent environmental benefits that go with it will be diminished. The owners of taxi companies and medallions stand much to lose, and it is in their interest to prevent an all out disruption of their industry.

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CHAPTER 3

The users of real-time dynamic ridesharing: Who are they?

Abstract

This study examines the current demographic characteristics and usage of dynamic ridesharing (DRS). The approach to this empirical research was quantitative based on a structured web-survey administered to a targeted audience of 306 DRS users. It was informative to learn the similarities and differences among the respondents to determine the value of implementing DRS as an alternative transportation mode. Descriptive statistics were used to explore DRS users' motivations that will ultimately provide opportunities for service improvements and expansion.

Internet- technology-enabled DRS is an emerging disruptive innovation of the transportation industry. DRS is being adopted rapidly by consumers, however little was known about the nature and level of activity of early adopters. Through an examination of a sample of the U.S. population who has adopted DRS, we had hoped to understand how the new technology is providing alternatives to single-occupant vehicle (SOV) use. The study provided a portrait of DRS users in urban areas nationally and explained how they are using this mode of transportation.

Keywords: dynamic ridesharing, DRS, survey, demographic, Uber, Lyft, SideCar, mobile communications

3. Introduction

In the past several years there has been a proliferation of web- and mobile app-based platforms offering drivers and passengers convenient matching using Internet and communication technologies (ICT) that are location-aware and operate in real-time (Agatz, et. al, 2012). The objective of this study was to examine the current state and directions of real-time ridesharing by learning the demographic characteristics of users via an Internet survey. Real-time ridesharing services such as Uber, Lyft, and SideCar are sometimes called *Transportation Network Companies* (TNCs) by municipal and state jurisdictions. TNC status distinguishes these services from traditionally regulated taxis and limousines, e.g., medallion-issued for-hire vehicles that are regulated, especially by the amount of vehicles that are permitted to operate in any one city on a regular basis. TNCs provide point-to-point transportation through app-based platforms on the web and commonly accessed through mobile devices. These services are referred to as Dynamic Ridesharing (DRS) within this study. Regarding the taxonomy of DRS's name, there is contention among transportation professionals and academics as to what should be the proper name of this service. Other names commonly used include e-hailing, on-demand ridesharing, and instant ridesharing. Most academics familiar with the DRS transport mode agree that it is primarily ridesharing for-hire assisted by Internet-enabled, location-aware mobile communications technology, and augmented with social media such as

Facebook and Twitter (Siddiqi & Buliung, 2013). Despite this agreement, variations on the name persist in the literature.

Examination of the user characteristics was accomplished via a 30 question survey administered to 306 DRS users over the Internet by SurveyMonkey, an Internet platform that provides consumer audiences. The author believed that a broad understanding of the users of DRS might lend insight into this mode of transportation that has the potential to fill the empty seats of single-occupant vehicles (SOVs). Despite push-back from the taxi and limousine industry who view DRS as a serious business disruption, DRS has been gaining popularity with consumers as a fast and convenient method of transport around busy urban areas. DRS is fast becoming the preferred method of securing point-to-point transportation, especially in cities (Rayle, et. al, 2014).

Up until this point, assumptions have been made regarding who are the users of DRS. Many application designers have relied on anecdotal information that assumes users are primarily young, affluent, city dwellers who would normally use traditional taxi and limousine service, but are instead opting for smartphone-based platforms for point-to-point rides (Nelson, 2015) . Such assumptions exclude deeper exploration of the full demographics, thus precluding DRS-designed systems for suburban and semi-rural areas where automobile use, especially SOVs, is dominant. Although some of the DRS platforms have created proprietary data that aims advertising at their primary users, there are fewer public studies examining the users of DRS (Rayle, et. al, 2014).

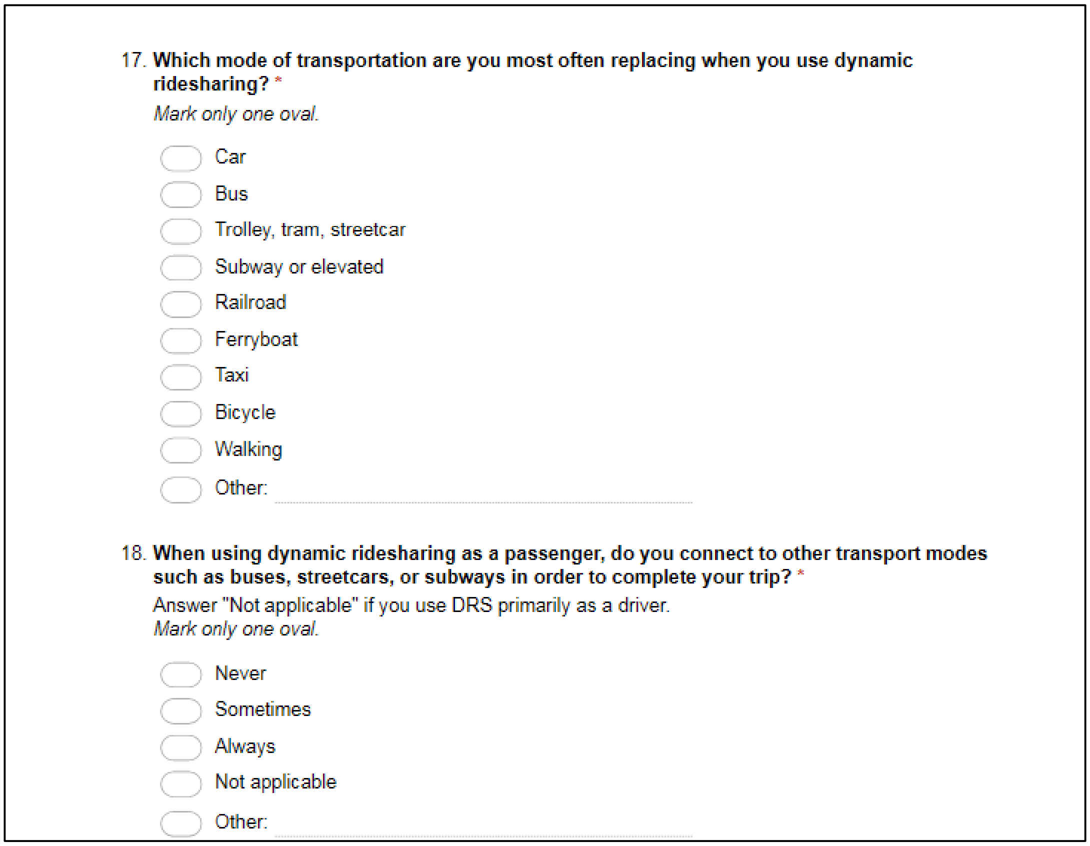
3.1 What is DRS?

DRS is a variant of ridesharing and carpooling that makes use of ICT to match rides between drivers and passengers in real-time (Agatz, et. al, 2012). The primary advancement allowing DRS to move forward from its early web-based beginnings is the Internet-enabled and location-aware mobile phone, also called a "smartphone", that uses an operating system (OS) much like a desktop computer. In conjunction with the smartphone, social media has played a role in the successful operation of DRS. Social media websites such as Facebook and Twitter have allowed real-time conversations between users. Social media has also lent facility to *trust and reputation systems* that have removed much of the trepidation inherent in getting into a car with a strange driver. Trust and reputation systems also allow passengers to rate driver behavior and vice versa. Smartphones also contain the enabling technology that allows drivers and passengers to communicate and locate each other in real-time using built-in Global Positioning System (GPS) navigation systems.

Mass adoption of the smartphone began in 2007 with the introduction of the iPhone by Apple, Inc., and has since been expanded by a proliferation of applications that have made DRS accessible and convenient to those seeking to provide or receive point-to-point transportation on demand. In 2008 other smartphones using similar technology were introduced, e.g., Android, an open-source operating system introduced by Google, Inc., making DRS-use widespread in not only the U.S. but also globally. With smartphone ownership reaching 65% of U.S. cellular consumers (Nielsen, 2014), an understanding of the demographic profile of DRS users can offer information on possible changing attitudes towards the relationship between consumers and their transportation choices. It is important to understand transportation preference since any changes in the sector will have a significant impact on the physical environment. The most recent estimate of transportation's share of carbon dioxide (CO_2) emissions is 32.9%; currently the largest among the energy consuming sectors (Davis, Diegel, & Boundy, 2014, p. 11-15).

3.2 Methodology and Instrument

User data demographic and activity was gathered through a 30–item questionnaire capturing reactions to existing DRS systems and rating DRS services. The survey was based on closed-end and Likert scale questions that explored users' demographic profiles as well as their attitudes towards DRS, and related concepts such as trust and reputation systems, automobile cost, and ownership. The survey was randomly administered to 306 respondents online by SurveyMonkey, an Internet platform that collects responses from an audience it provides for a set fee (Figure 3.1). The respondents were selected from SurveyMonkey's in-house audience members who were asked the qualifying question, "Have you in the past 30 days used dynamic ridesharing (Uber, Lyft, etc.)?" Audience members did not receive compensation for their participation other than a small monetary contribution on their behalf through SurveyMonkey to charities of their choice (SurveyMonkey, 2015) (APPENDIX A & B)



17. **Which mode of transportation are you most often replacing when you use dynamic ridesharing?** *

Mark only one oval.

- Car
- Bus
- Trolley, tram, streetcar
- Subway or elevated
- Railroad
- Ferryboat
- Taxi
- Bicycle
- Walking
- Other: ____________

18. **When using dynamic ridesharing as a passenger, do you connect to other transport modes such as buses, streetcars, or subways in order to complete your trip?** *

Answer "Not applicable" if you use DRS primarily as a driver.

Mark only one oval.

- Never
- Sometimes
- Always
- Not applicable
- Other: ____________

Figure 3.1: **A sample of survey instrument questions and scales.**

3.2.1 Demographic characteristics of DRS users

Table 3.1 illustrates the demographic characteristics of DRS users. One hundred percent of the total sample was from the U.S. Gender was split at 50.65% (155) male, and 49.35% (151) females. The race of respondents was predominately white at 88.00% (271). The disproportionate percentage of white users corresponds with the general demographic profile of U.S. taxi passengers and DRS drivers who, in general, tend to be overwhelmingly white. Relationship status indicates married 45.78% (141), and single, never married 33.77% (104) were the majority of all respondents. Most respondents came from the Pacific region with 28.53% (214) of responses. The high representation of the

Pacific region corresponds to the location's role as the origin of DRS, with San Francisco and Seattle populations as two of the earliest cities to adopt the service. Educational attainment was high with the majority of respondents reporting college graduation 41.50% (127) and a high number completing graduate school at 30.39% (93). Respondents tended to be not only college graduates, but also holders of higher degrees. There was a substantial number of respondents reporting income above $200,000 at 23.86% (73). It is possible this reflects the Pacific regions reporting dominance where incomes tend to be higher than in the rest of the nation. Table 3.1 also indicates

Table 3.1: Summary of respondents' demographic profile

Demographic	Results
Gender	Male 50.65 % (155); Female 49.35% (151)
Age	18-24 17.21% (53); 25 to 34 30.19% (93); 35-44 15.26% (47); 45-54 17.86% (55); 55 to 64 12.99% (40); 65 or older 6.49% (20)
Relationship status	Married 45.78% (141); Widowed 0.97% (3), Divorced 2.60%(8); Separated 0.65% (2); Domestic partnership or civil union 1.62% (5); Single, but cohabitating with a significant other 14.61% (45); and Single, never married 33.77% (104)
U.S. Region (note: See map)	New England 8.00% (60); Middle Atlantic 13.47% (101); East North Central 11.47% (86); West North Central 5.60% (42); South Atlantic 17.07% (128); East South Central 2.80% (21); West South Central 6.93% (52); Mountain 6.13% (46); Pacific 28.53% (214)
Educational attainment	High school graduate 1.30% (4); Some college 16.56% (51); College graduate 41.23% (127); Some graduate school 10.06% (31); Completed graduate school 30.19% (93)
Income	$0-$24,999 7.19% (22); $25,000-$49,000 11.44% (35); $50,000-$74,000 16.34% (50); $75,000-$99,000 10.31% (31); $100,000-$124,000 11.11% (34); $125,000-$149,000 7.19% (22); $150,000-$174,000 7.52% (7); $175,000-$199,000 5.23% (8); $200,000 and up 23.86% (73)
Ethnicity	White 87.99% (271); African-American 0.97% (3); Asian 4.55% (14); Multiple races 6.49% (20)
Employment	Employed, full-time 74.35% (229); Employed, part time 7.79% (24); Not employed, looking for work

	3.57% (11); Not employed, not looking for work 4.87%; (15) Retired 8.12% (25); Disabled, not able to work 1.30% (4)
Currently enrolled as a student	Yes, full time in graduate school 4.22% (13); Yes, part time in graduate school 3.90% (12); Yes, full time in four year undergraduate 6.17% (19); Yes, part time in four year undergraduate 0.65% (2); Yes, full time in two year undergraduate 0.65% (2); Yes, part time in two year undergraduate 0.32% (1); Yes, at a high school or equivalent 0.00% (0); Not currently enrolled as a student 84.09% (259)
Housing tenure	Rent 49.03% (151); Own 48.38% (149); Other 2.60% (8)
Vehicles available per household	0- 7.21% (53); 1- 29.22% (90); 2- 36.36%(112); 3- 10.71% (33); 4- 4.87% (15); 5+ 1.62% (5)
Principal Industry of Employment	Advertising & Marketing 4.56% (14); Education 9.77% (30); Finance & Financial Services 7.17% (22) Healthcare & Pharmaceuticals 9.12% (28); Nonprofit 7.82% (24); Telecommunications, Technology, Internet & Electronics 12.70% (39); Currently not Employed 8.14% (25); Other 14.66% (45)

that the majority of respondents were employed full time at 74.35% (229). Housing tenure for respondents was even with 49.03% (151) reporting they rent, and 48.38% (149) reporting ownership. Table 3.1 indicates that the majority of respondents, 36.6% (112), had two vehicles available to their household. Only 17.21% (53) had zero vehicles available. Respondents were asked if they were currently enrolled as students, and an overwhelming majority answered *no* to this question at 84.09% (259). Thus, the survey data can support that DRS is not a phenomenon just among college students. Finally, respondents reported a diverse mix of industries that employed them. The largest employment representatives were education at 9.77% (30), healthcare and pharmaceuticals at 9.12% (28), Telecommunications, Internet, and electronics at 12.70% (39), currently not employed at 8.14% (25), and a large group who answered "other" at 14.66% (45). Those who answered "other" to the *Principal Industry of Employment* question tended to duplicate categories that were presented in the survey, e.g. technology and engineering for "Telecommunications, Technology, Internet & Electronics", and retired and disabled for "I am currently not employed".

3.3 Demographic Comparisons

Demographic data was collected for each respondent. The demographic data allowed us to analyze differences between subgroups (e.g. age, gender, educational attainment, income, etc.) and aspects of DRS such as selection of platform (e.g. UberX, Lyft, SideCar, etc.), frequency of use, access to amenities, replacements of other modes (e.g. personal car, bus, subway, etc.), and vehicle maintenance cost among other characteristics of DRS.

3.3.1 Demographic comparison based on gender

Question 21, "What is your Gender?" explored how male and female users perceived DRS, either differently or equally. The survey results were balanced between males and female users: Male 50.7% (155), Female 48.7% (149) (Table 3.1). Preference of DRS platform, Question 4, did not indicate any significant difference in choice among males or females, however, it did confirm the dominance of Uber Black/UberX, Lyft, and SideCar as the most preferred platforms among either gender (Table 3.2).

Table 3.2: Question 4. Which of the DRS applications on your smartphone have you used? Please check all that apply.

DRS Platform	Percent	Frequency
Uber Black	36.73%	(119)
UberX	83.33%	(270)
Lyft	28.09%	(91)
SideCar	3.40%	(11)
Hitch-a-Ride	1.23%	(4)
Car.ma	1.23%	(4)
Summon	1.23%	(4)
Wingz	0.93%	(3)
Other	2.78%	(9)

N = 306

Question 7, " Which mode of transportation are you most often replacing when you use dynamic ridesharing?" did reveal differences between the genders in how they substituted other modes for DRS. For example, both males and females selected "Personal car" and "Taxi" as the two transportation modes most often replaced by DRS in 73% (222) of the cases. In the "Personal car" category, females were found more often than males to replace their personal vehicles: male 37.42% (58), female 47.02% (71). The response may reflect the economic reality of less access to automobile ownership due to lower incomes realized by adult female workers. Conversely, males in the survey tended more than females to replace taxis with DRS: male 37.42% (58), female 23.84% (36). Higher taxi use and its concomitant substitution with DRS might indicate the higher spending power of male users who have more access than females to premium on-demand transportation. The result in the difference among taxi replacement indicates that there is evidence of a relationship between gender and taxi replacement (Chi-square = 14.866, df 8, p = 0.05).

Supporting taxi replacement, Question 6 asked, "People use dynamic ridesharing to access various services and amenities. Please tell us where you have traveled to using a dynamic ridesharing service?" indicates fairly even use among males and females except in the category "Work". When choosing a destination using DRS, males traveled significantly more to work than females: male 45.81% (71), female 30.46% (46).

Question 9 explored a fundamental aspect of DRS: the improved mobility with its ability to fill empty vehicle seats. The implication for this is freer flowing roads that utilize lane capacity more efficiently. Further benefits to the environment are realized with more passengers traveling in fewer vehicles. Thus, when asked "When using dynamic ridesharing as a passenger, on average how many people, including yourself, were passengers in the vehicle?" respondents were being asked to help reveal whether DRS works as a transportation demand management (TDM) strategy by reducing single occupancy vehicles (SOV), or if it was simply a variation of taxis and limousines cruising city streets for hours with a single driver picking up one passenger on average (Figure 3.2). Question 9 offered for answer choices: one, two, three more, or not applicable due to the respondent's role as primarily a driver, in which case the respondent had a choice of opting out of the question. All in responses in Question 9 assume the exclusion of the driver, e.g. an answer of 2 means two passengers and not one driver and one passenger. There is fairly even distribution among males and females except in category "three or more" where females answered significantly higher than males: male 10.97% (17), female 23.18% (35). What is interesting about this result from a DRS standpoint is that reluctance to enter a car with a stranger was often a hindrance to DRS until the introduction of mandatory driving record and criminal background checks for drivers. This result could be evidence that such security checks are convincing among female respondents. Statistical significance indicates strong evidence of a relationship between gender and number of passengers per vehicle (Chi-Square = 8.615, df = 3, $p < 0.05$) (Figure 3.2). This relationship is further substantiated in Question 11, "I am less concerned about safety and security knowing the driver has had a criminal background check and is covered with sufficient liability insurance in the event of an accident.", where female respondents answered much higher than males on the scale stating "Strongly agree": male 29.68% (46), female 45.04% (68).

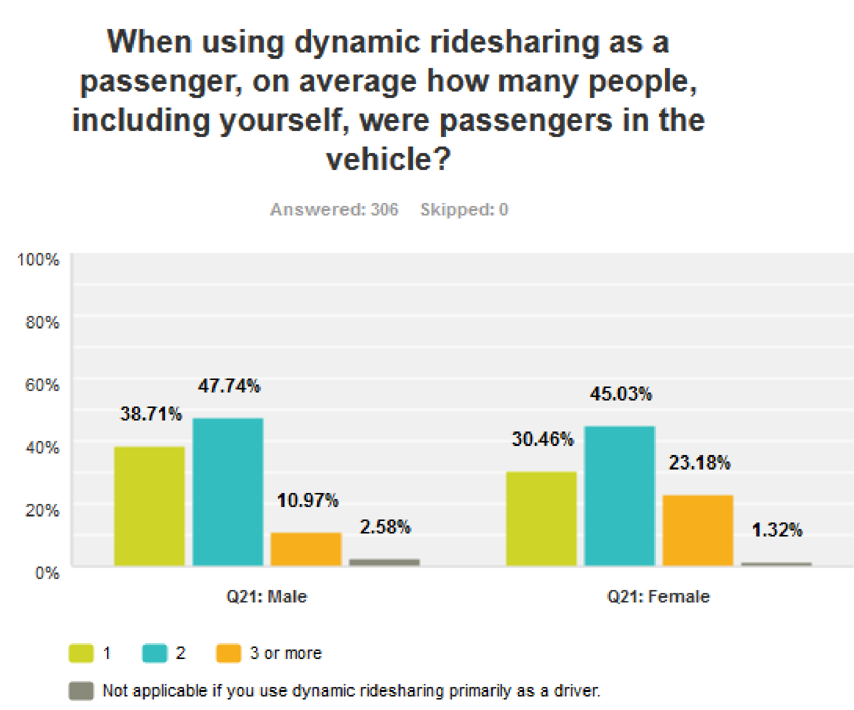


Figure 3.2: Gender compared with Question 9: "When using dynamic ridesharing as a passenger, how many people, including yourself, were passengers in the vehicle?"

In Question 15, "To what extent is not owning a car a significant factor in choosing dynamic ridesharing?" females answered with a higher response rate of a combined 33.77% (51) for answer choices "Most significant" and "Significant". Males answered significantly lower at 13.55% (21) for "Most significant" and "Significant". There is very strong evidence of a relationship between gender and choosing DRS due to lack of owning a car (Chi-Square = 17.588. df = 5, $p < 0.05$).

Question 16 explored users' attitudes towards DRS as an alternative transportation strategy to reduce the automotive impact on the physical environment. The Likert scale question of one to five measuring from "Very important" to "Not important" with regards to the respondent's choice being made based on environmental considerations. For this question, males answered significantly lower stating that the environment was not important in choosing DRS: male 41.94% (65), female 22.53% (34). There is statistical evidence of a relationship between gender and choosing DRS for concern regarding the physical environment (Chi-Square = 14.511, df = 4, $p < 0.05$).

There were similar answers for both genders in Question 19 which asked, "To what extent is using dynamic ridesharing a better option than using public transportation?" Both genders answered affirmatively that DRS was a better option than public transportation. The Likert question again had a scale of one to five ranging from "Better" to "Not better". Within the first three categories of the scale, males answered affirmatively 89.04% (138), and females 94.04% (142). The result taken from a sample from each region of the nation could indicate an overall failure of public transportation nationally. Further research is needed to confirm whether this is localized to a specific region(s) or a national issue.

However, when asked in Question 20, "Would you consider moving to a larger home in an area with limited or no public transportation if dynamic ridesharing was a reliable option?" the answer was generally negative. Males answered the question scale with a response of "Moderately consider, 25.16% (39), and females 32.45% (49). The "Not considered" category was the highest with males answering 38.06% (59), and females 25.83% (39). Hence, DRS appears to be appreciated more by urban users who see it as a substitute for public transportation. Suburban, or potential suburban users, do not see DRS as a transportation system that fits in less populated areas. This is significant as the majority of automobile activity is in less densely populated areas and could benefit from an adaptation of DRS to a suburban setting (Badger, 2015).

In summary, there is little difference in the way males and females use DRS. However, there appears to be statistical significance in some areas to indicate differences based on gender. The results indicate that for males, it appears that DRS is used as a replacement for taxis and limousines, or in situations where a for-hire vehicle (FHV) is appropriate, i.e. business travel, event travel, etc. Also, males are less concerned with the criminal background check and screening of drivers and less concerned with the environmentally positive aspects of DRS. Female users are most often replacing a personal car or bus with DRS. As indicated in Question 15, females answered significantly higher than males regarding a lack of car ownership as a factor in choosing

DRS. This could be indicative of socioeconomic factors that constrain car ownership for female DRS users.

3.3.2 Demographic comparison based on age

When respondents were asked about their age in question 22, they responded as in Table 3.3. Nearly 50% (47.06%) of respondents were in the first two categories representing 18 to 34-year-olds. As a single cohort, the majority of the young DRS users were in the 25 to 34 group representing almost one-third of all respondents: 30.07% (92). The two youngest groups represents the so-called Millennial Generation, a name attributed to the demographic cohort representing people born approximately between 1980 and 2000 (Strauss & Howe, 2000). Thus, the survey revealed that millennials were nearly half of all DRS, a statistic in line with other studies that show this group trending away from car ownership and becoming more deeply invested in social media and its attendant technologies such as smartphones and tablets (Nelson, 2015).

Table 3.3: Question 21. What is your age?

Age group	Percent	Frequency
18 to 24	16.99%	52
25 to 34	30.07%	92
35 to 44	15.36%	47
45 to 54	17.97%	55
55 to 64	13.07%	40
65 or older	6.54%	20
Total	100.00%	306

N= 306

When asked about which mode of transportation was being replaced with DRS, the 18 to 24 and 25 to 34 cohorts answered that they were mostly replacing their personal car (30.19% and 38.71% respectively) and taxi (20.75% and 33.33% respectively). An anomaly was observed, however, among the 18 to 24 cohort who reported replacing "walking" with DRS at 18.87% (10). This high score was significantly more than the next highest group, 45 to 54, who reported 3.64% (2) replacing walking with DRS. The explanation for this high score could be attributed to the group's lower income potential and its implication for lower car ownership and taxi use. Respondents of the next three cohorts, 35 to 44, 45 to 54, and 55 to 64, reported replacing a personal car and taxi more often than other modes, however, percentages for personal car were higher than the younger cohorts: 57.45% (27), 50.91% (28), and 45.00% (18) respectively. Explanations for such high replacement of personal vehicles with DRS can be attributed to the higher degree of car ownership among these cohorts (Figure 3.3). Crosstabulation was performed comparing age and mode of transportation substituted for DRS. The results indicated that there is very strong evidence of a relationship between age and the mode of transportation substituted for DRS (Chi-Square = 86.815, df = 40, $p < 0.001$).

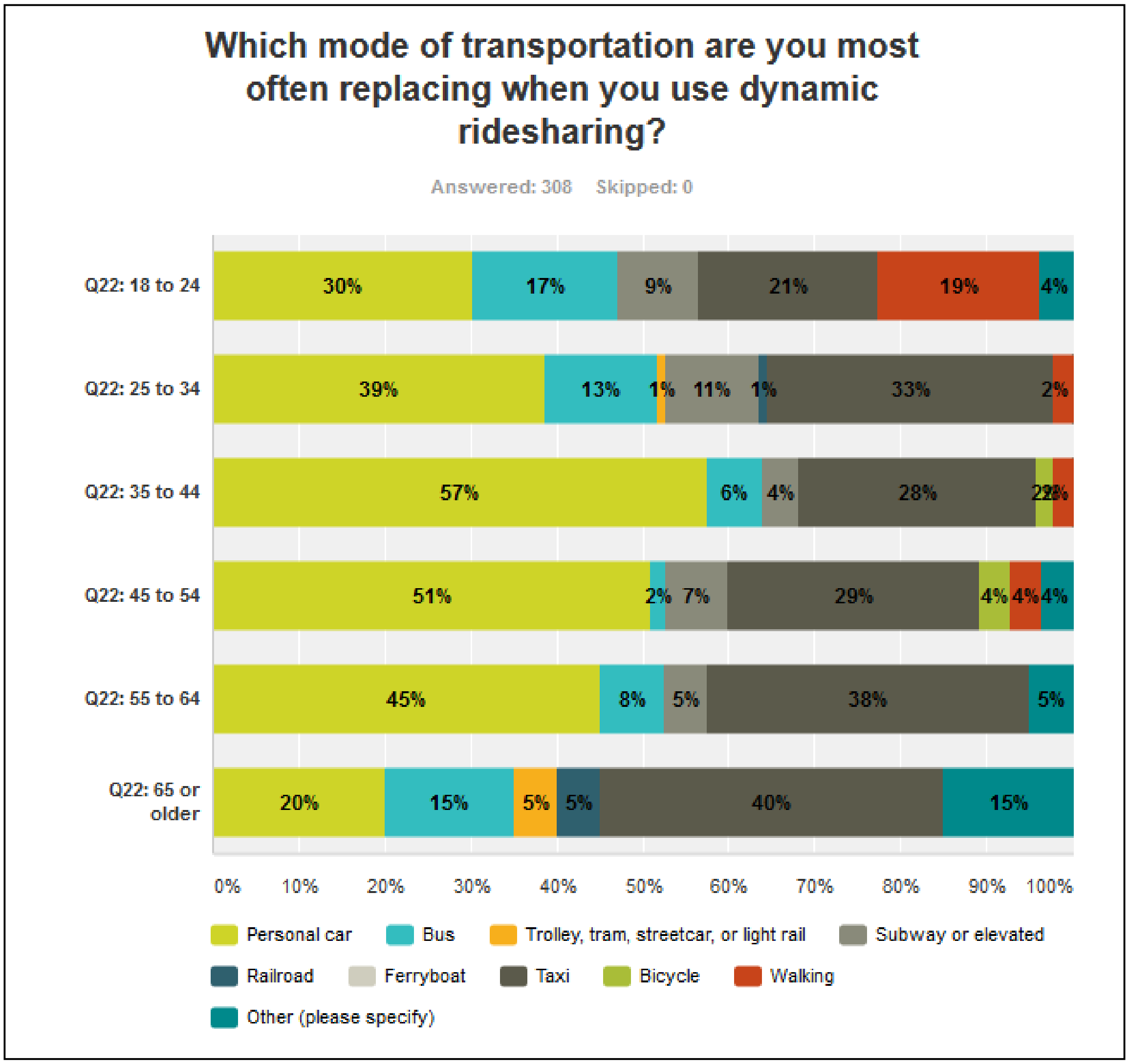


Figure 3.3: Age compared with replacement of transport mode with DRS

Users were asked whether they connected to other transport modes such as buses, streetcars or subways to complete their trips. All age groups responded "Never" in more than 50% of cases with "Sometime" in about one-third of cases. The purpose of this question was to determine whether DRS was being used intermodally to connect with public transportation. The reply "Sometimes" indicates an area for future research and application of DRS. Perhaps in less densely populated areas, DRS could be promoted as a means of building an itinerary that is less reliant on one's personal vehicle (Figure 3.4).

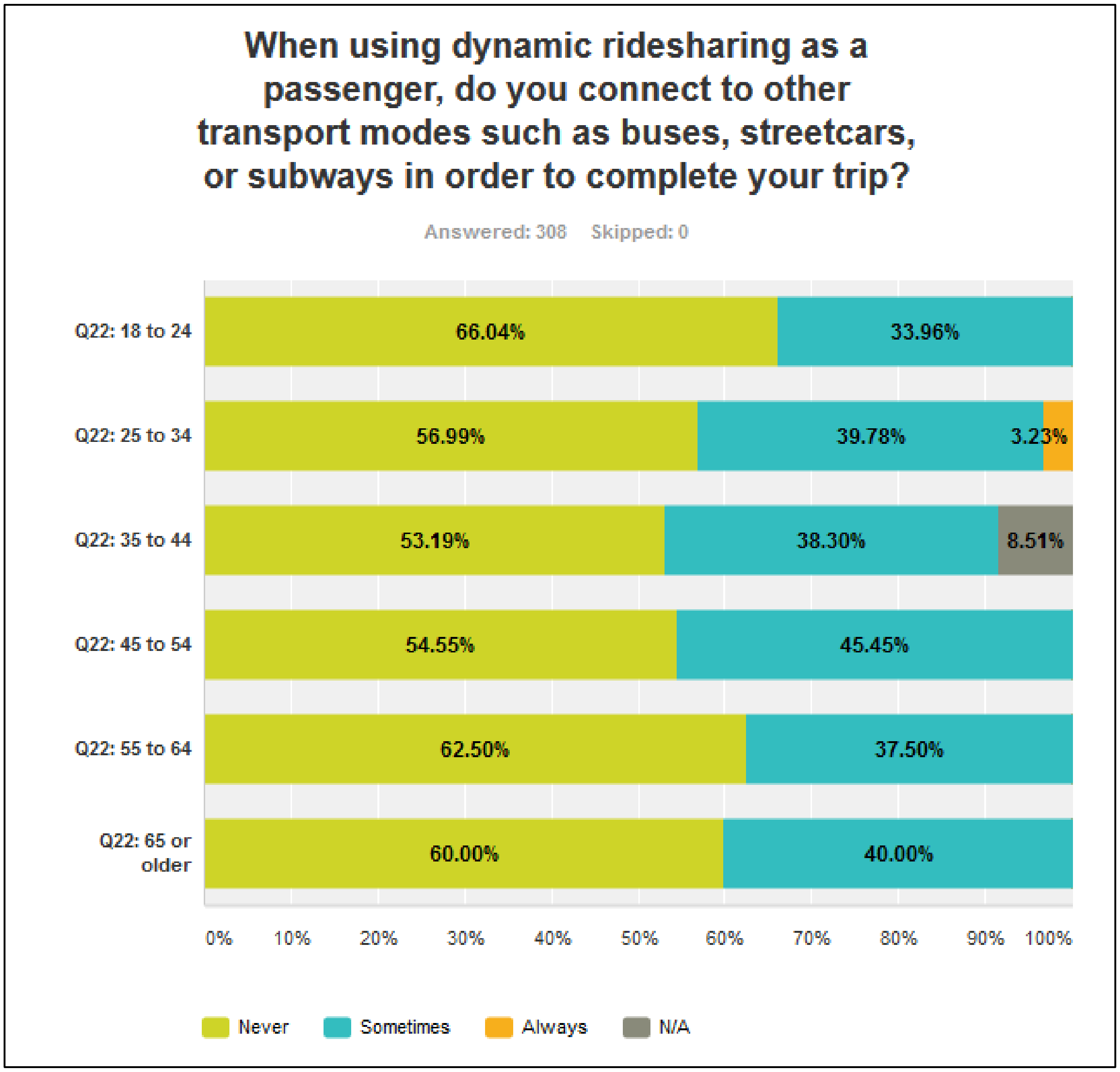


Figure 3.4: Age compared with "When using dynamic ridesharing as a passenger, do you connect to other transport modes such as buses, streetcars, or subways to complete your trip?"

Users were asked about how many people on average, including themselves, were passengers in a vehicle. The responses were one, two, or three or more. This question tries to explore the fundamental benefit of DRS, which is the ability to fill empty vehicle seats thereby reducing road congestion through the efficient use of lane capacity. There was normal distribution among the responses for the two younger cohorts, 18 to 34. However, an anomaly is observed in the 18 to 24 group showing a higher response rate for "three or more" than all other age groups. Among the 18 to 24-year-olds who were asked the number of passengers in a vehicle, 34% responded with "three or more". This response rate was approximately two times higher than all other age groups. Crosstabulation analysis for age groups (Question 22) compared to number of passengers in vehicle (Question 9) indicate that there is very strong evidence of a relationship between the variables (Chi-square = 39.097, df = 15, $p < 0.001$).

Respondents were asked "To what extent is not owning a car a significant factor in choosing dynamic ridesharing?". The question answer was comprised of a scale of one to five with one indicating "Most significant" and five indicating "Not significant". Respondents who were DRS drivers were given the choice of opting out of this question. All age groups tended to have a high response rate indicating that the lack of car ownership was either "Less significant" or "Not significant" as a factor in choosing DRS. However, the 18-24 group indicated that 24.42% (14) felt that not owning a car was "Most significant" in their decision to use DRS. The response rate of the 18-24 cohort was significantly higher than the response to "Most significant" of all other groups.

In the survey, Question 16 was included to explore respondents' attitudes regarding the environmental benefits of DRS. In an early study of DRS, Levofsky and Greenberg (2001) examined the environmental degradation attributed severe traffic congestion. More recently, Deakin, Frick, and Shively (2012) conducted a feasibility study conducted at the University of California at Berkeley. According to the results of the study, participants stated that their primary reason for sharing rides was to save time and money. However, a secondary reason given was to reduce environmental impacts caused by driving. The question in our survey went more directly to the issue and asked, "To what extent is reducing impacts on the physical environment a significant factor in choosing dynamic ridesharing?" The 55 to 64 cohort had the highest response rate favoring DRS as a means to reduce negative impacts on the environment (Figure 3.5). The 55 to 64 group rated that is was "Moderately important", 37.50% (15). The group also had the lowest negative response among all groups, i.e. "Not important", 22.50% (9).

When users were asked, "To what extent is using dynamic ridesharing a better option than using a regular taxi or hired limousine?", on a scale of one to five, with one meaning "Better" and five meaning "Not better", all cohorts entered a response rate above 50% in the "Better" category. The 55 to 64 group had the highest response rate of "Better" at 62.50% (25) (Figure 3.6). The unanimity of the response was similar in question 19 which asked, "To what extent is using dynamic ridesharing a better option than using public transportation?". All except cohort, 65 or older, answered with a highest response rate of "Better" on the scale. The 65 or older group gave its highest rating to "Somewhat better", 45.00% (9) (Figure 3.7).

Finally, age categorized respondents were asked to rate on a scale of one to five the question, "Would you consider moving to a larger home in an area with limited or no public transportation if dynamic ridesharing was a reliable option?" . Response by the age cohorts was similarly mixed as with gender in the previous section. The younger groups, 18 to 24 and 25 to 34, gave highest response rate to "Moderately consider", 33.96% (18) and 36.56% (34) respectively. The older groups were unanimous in giving the highest response to "Not consider".

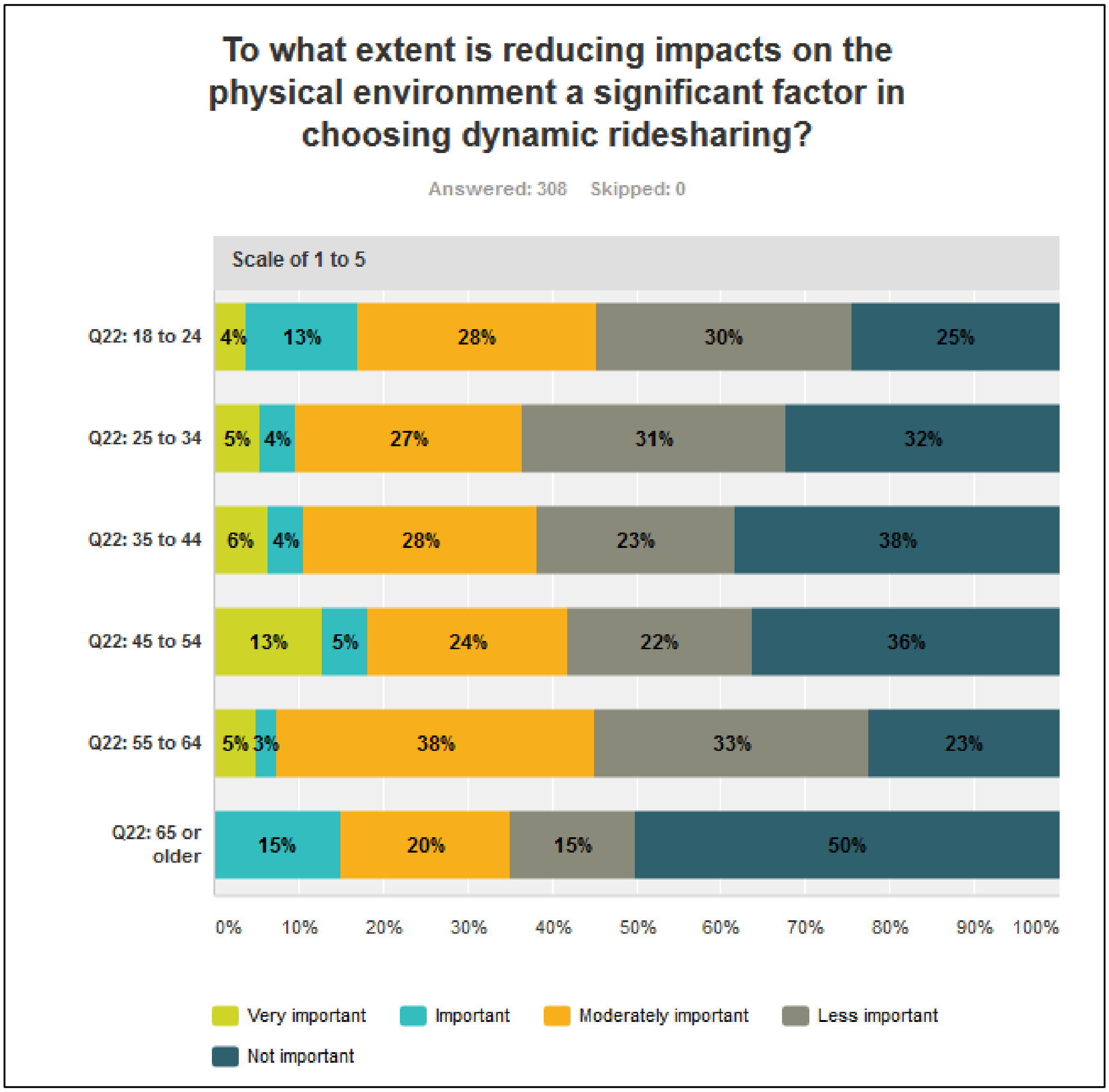


Figure 3.5. Age compared with Question 16 "To what extent is reducing impacts on the physical environment a significant factor in choosing dynamic ridesharing?"

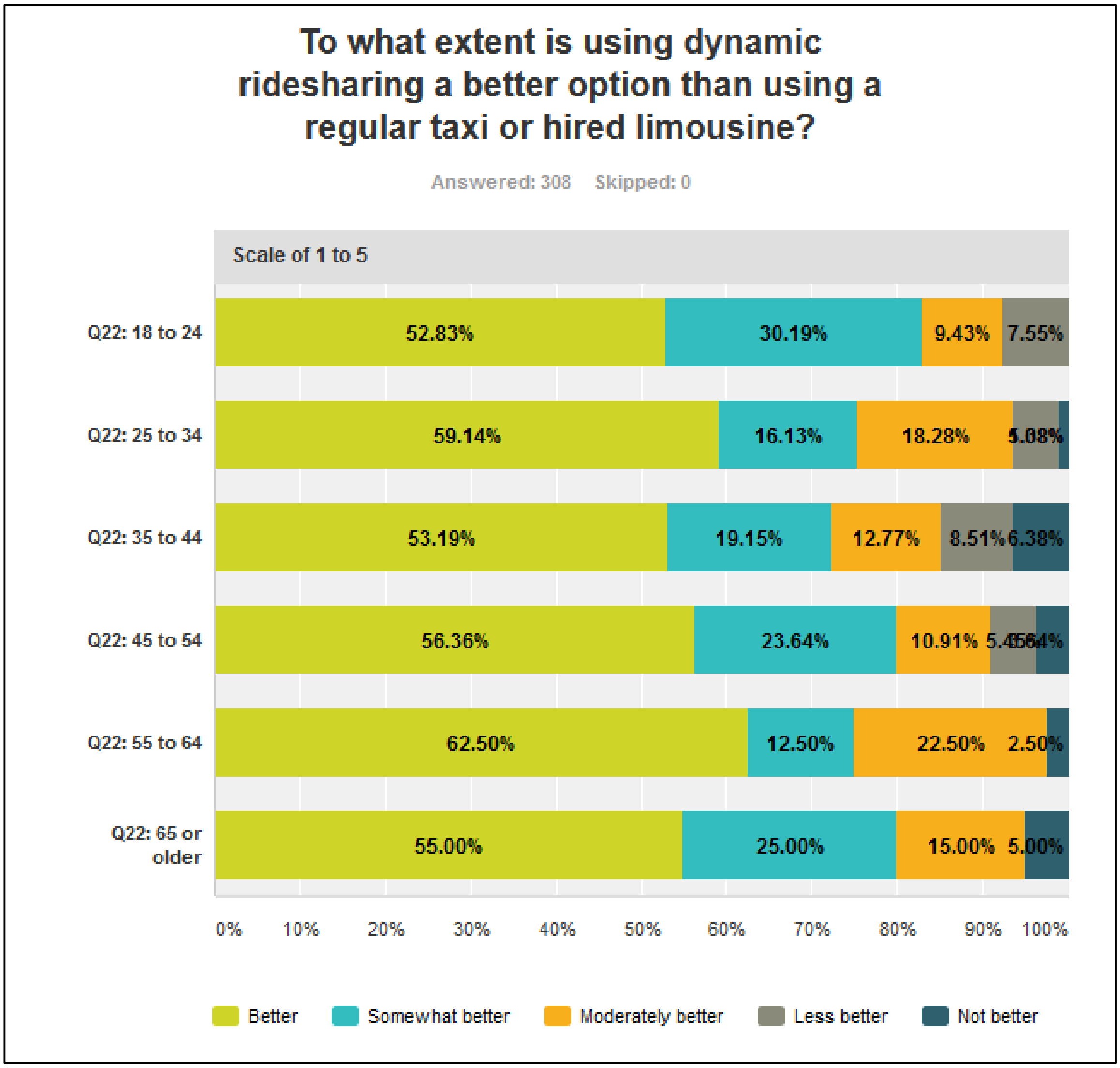


Figure 3.6. Age compared with Question 18 "To what extent is using dynamic ridesharing a better option than using a regular taxi or hired limousine?"

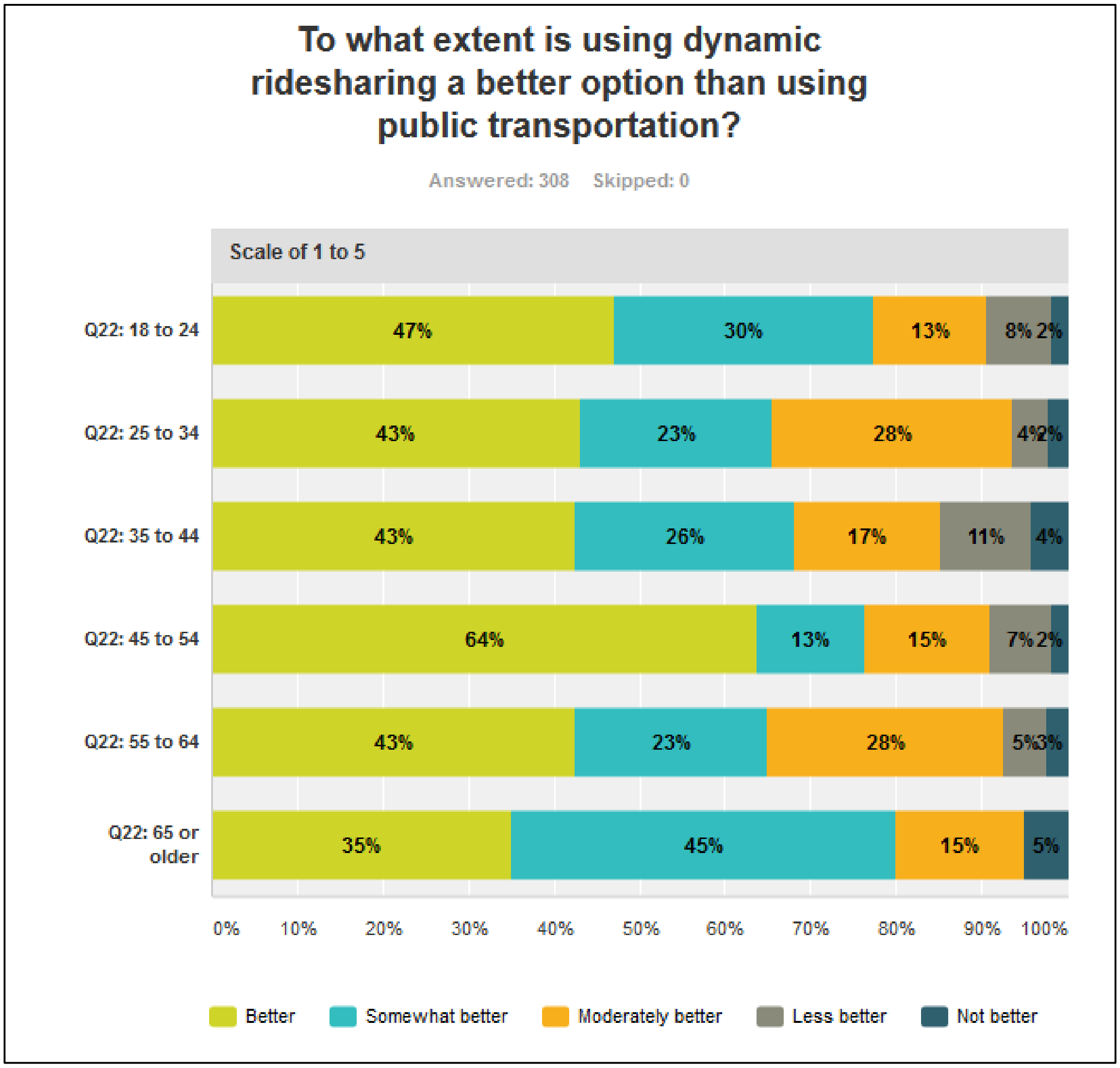


Figure 3.7. Age compared to Question 19 "To what extent is using dynamic ridesharing a better option than using public transportation?"

3.3.3 Demographic comparison based on educational attainment

The survey asked respondents to report their highest level of education completed. The majority of respondents reported educational attainment from "Some college" to "Completed graduate school", 98.04% (302). There were zero respondents reporting the following: "Primary school" and "Some high school". The following categories had one respondent each: "Did not attend school", and "Vocational or trade school". It appears to be sufficient to let the basic statistics stand as they are due to the nature of the data being skewed so greatly towards college educated respondents. Future research into reasons why individuals below college level education are nearly absent may be necessary. Ethnicity in question 25 on the survey was also skewed toward White at 90% (271). In the United States, there are differences in educational attainment by race with attainment higher for Whites and Asians than for African-Americans and Hispanics (Ryan & Siebens, 2009).

3.2.4 Demographic comparison based on race

When asked to identify their ethnicity respondents reported White with near unanimity, 90%, (271). The remaining 10% was comprised of Black or African-American, 0.97%, (3), Asian, 4.55% (14), and multiple races, 6.49% (20). Two groups reported zero respondents: American Indian or Alaskan Native, and Native Hawaiian or other Pacific Islander. We included White and Non-White Hispanic cohorts in the original survey (Appendix A).[1]

Since Question 25 was skewed heavily toward the White category, little statistical evidence could be gleaned that was relevant to DRS. When race was compared to Question 31, "Which of the following best describes the principal industry of your employment?", Whites and Asians had similar response rates for the two most often

[1] White and Non-White Hispanic cohorts were deleted from the live instrument due to error in the survey administration by the vendor.

chosen industries: Education, and Telecommunication, Technology, Internet, and Electronics: 9.63% (26), 12.22% (33), and 14.29% (2), 28.57% (4) respectively. African-Americans selected Non-profit unanimously, 100% (3).

3.3.5 Demographic comparison based on housing tenure

When DRS users were asked about housing tenure, they reported a near even split between renting, 49.03% (151) and owning their homes, 48.38% (149). The remainder was comprised of respondents who answered "other," 2.60% (8). All but one of the "other" category referred to either living at home with a relative or in a college dorm. One respondent reported renting and owning two residences.

Distribution was normal and evenly split when respondents named the DRS platforms that they have used. As in other demographic groups, the majority of users had chosen among Uber Black, UberX, and Lyft. UberX, Uber's basic ridesharing service, was the most often reported with renters giving a response rate of 91.39% (138) and homeowners responding lower at 75.17% (112). Homeowners tended to use Uber Black more often than renters, 45.64% (68) and 27.15% (41) respectively. Uber Black is Uber's premium service providing late model luxury cars and is primarily used for airport and special event transportation.

When users were asked, "To what extent is not owning a car a significant factor in choosing dynamic ridesharing?", renters and homeowners responded as in Figure 3.8. Renters responded that not owning a car was a significant factor in choosing a DRS service,25.83% (39). In contrast, homeowners responded that car ownership was not a significant factor, 38.93% (58). Respondents who were primarily DRS users were given the opportunity to opt out of this question.

Respondents were asked in Question 16, "To what extent is reducing impacts on the physical environment a significant factor in choosing dynamic ridesharing?", they replied as in Figure 3.9. The majority in each cohort answered "Not important": renters 30.46% (46), and owners 34.90% (52). Further research on users' attitudes about DRS would benefit promoting its environmentally beneficial offerings. The age cohort 55 to 64 appears to thus be far the only demographic group that appreciated this aspect of DRS (Figure 3.5).

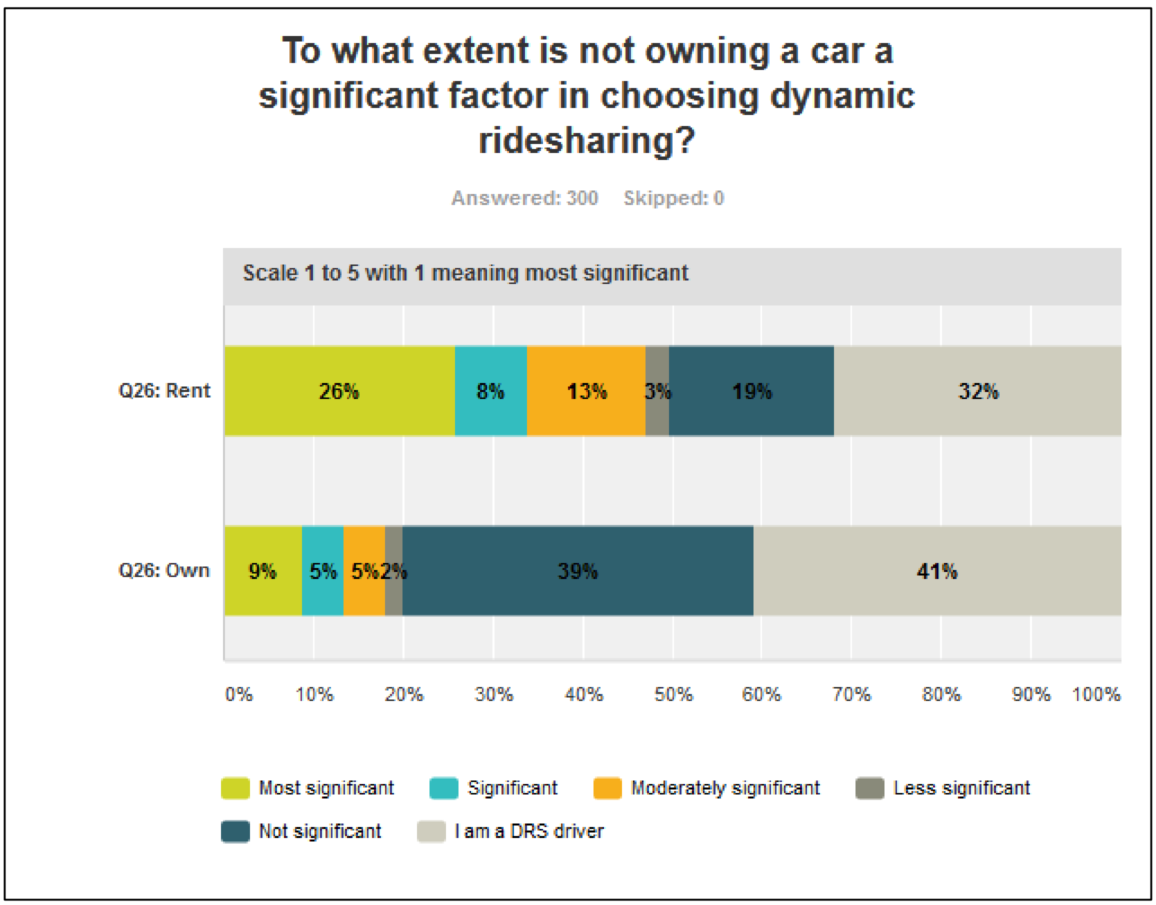


Figure 3.8. Housing tenure compared to Question 15 "To what extent is not owning a car a significant factor in choosing dynamic ridesharing?"

Question 20 asked users "Would you consider moving to a larger home in an area with limited or no public transportation if dynamic ridesharing were a reliable option?" The purpose of this question was to examine users' openness to DRS in less densely populated areas. Renters tended to favor DRS in a less densely populated setting giving a response rate of "Moderately consider" on the Likert scale question, 30.46% (46). Homeowners gave a response of "Not consider", 42.28% (63), perhaps due to their familiarity with suburban settings that are usually seen as the realm of the private automobile.

3.2.6 Demographic comparison based on relationship status

When asked "Which of the following best describes your current relationship status?", the split was even between "Married"/"In a domestic partnership or civil union", 47.40% (146) and "Single, never married"/"Single, but cohabitating with a significant other" 48.38%, (149) (Figure 3.10) Widowed, divorced,

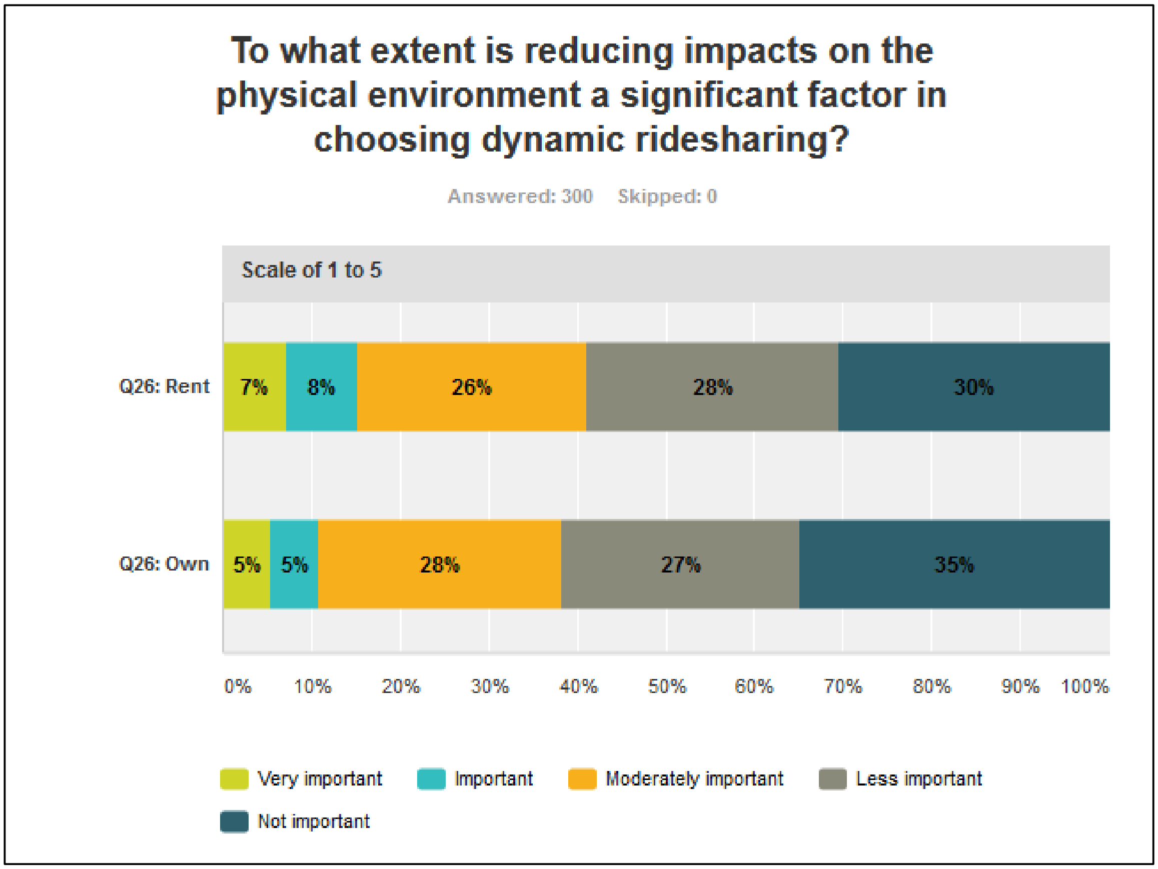


Figure 3.9. Housing tenure compared to "To what extent is reducing impacts on the physical environment a significant factor in choosing dynamic ridesharing?"

and separated comprised the smallest cohort with 4.22% (13), perhaps related to the fact that there were fewer respondents in the 65 and above cohort, 6.54% (20) (Table 3.3).

Regarding relationship status, there was general unanimity among cohorts in Question 17, "To what extent is not owning a car a significant factor in choosing dynamic ridesharing?". Both the "Married"/"In a domestic partnership or civil union" and "Single, never married"/"Single, but cohabitating with a significant other" groups gave highest response rates to the combined scale answers "Less significant", and "Not significant", 73.05% (103) and 55.55% (25) respectively (Figure 3.11). The results indicate that based on relationship status, users were making choice to choose DRS irrespective of car ownership

When users were asked which mode of transportation was most often being replaced by DRS (Question 7), they responded as in Figure 3.12. As with demographic groups previously examined in the survey, the majority were replacing their person car and taxis with DRS. There is very strong evidence of a relationship between relationship status and substitution of transportation mode with DRS (Chi-square = 89.768, df = 48, $p < 0.001$).

3.3.7 Demographic comparison based on the number of available vehicles in household

In Question 28, users were asked about the number of available vehicles in their household (Figure 3.13). Vehicles included passenger cars, vans, light trucks, or motorcycles.

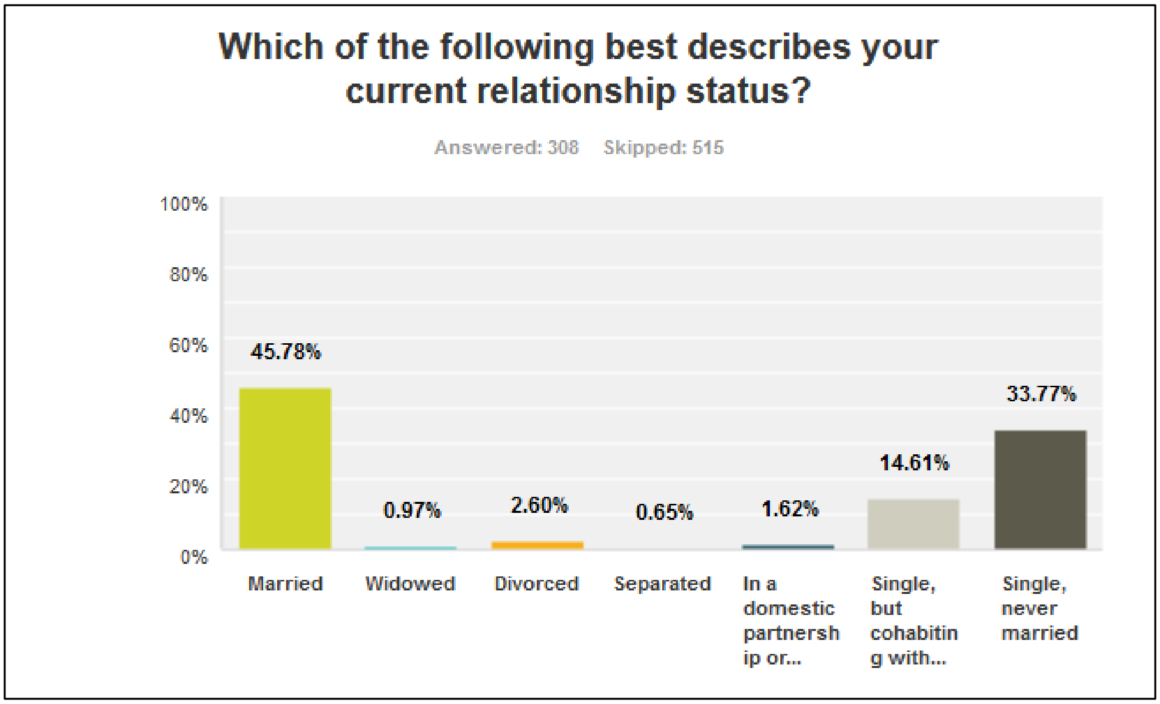


Figure 3.10. Question 27, relationship status of DRS users.

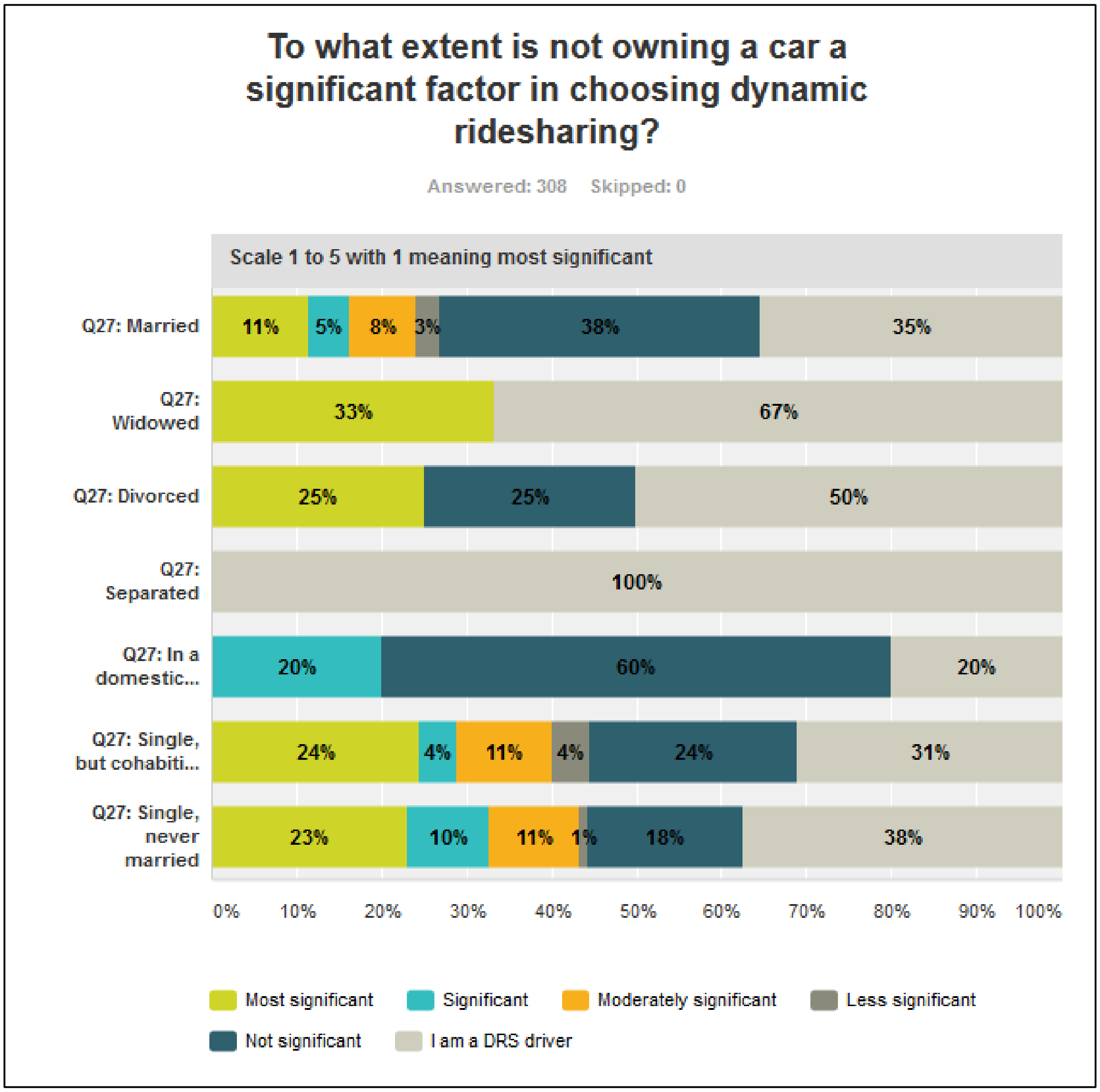
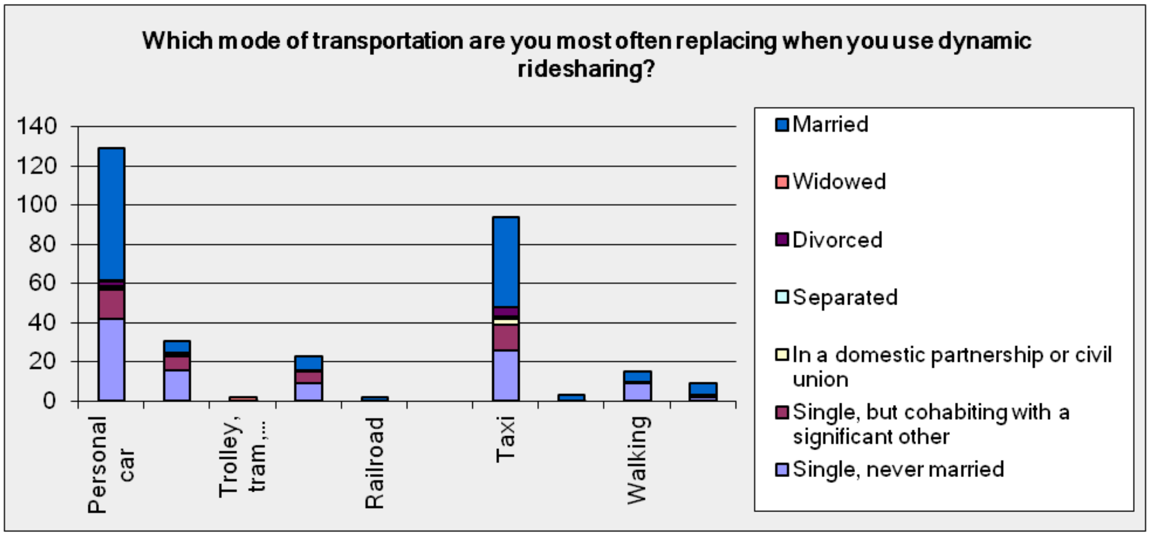


Figure 3.11. Relationship status compared to Question 17 "To what extent is not owning a car a significant factor in choosing dynamic ridesharing?"



Answer Options	Married	Widowed	Divorced	Separated	In a domestic	Single, but cohabiting	Single, never married	Response Percent	Response Count
Personal car	67	1	2	1	1	15	42	41.9%	129
Bus	6	1	0	0	1	7	16	10.1%	31
Trolley, tram, streetcar, or light rail	0	1	0	0	0	1	0	0.6%	2
Subway or elevated	7	0	1	0	0	6	9	7.5%	23
Railroad	2	0	0	0	0	0	0	0.6%	2
Ferry boat	0	0	0	0	0	0	0	0.0%	0
Taxi	46	0	5	1	3	13	26	30.5%	94
Bicycle	2	0	0	0	0	1	0	1.0%	3
Walking	5	0	0	0	0	1	9	4.9%	15
Other (please specify)	6	0	0	0	0	1	2	2.9%	9
								answered question	308
								skipped question	0

Figure 3.12. Relationship status compared with Question 7, "Which mode of transportation are you most often replacing when you use dynamic ridesharing?"

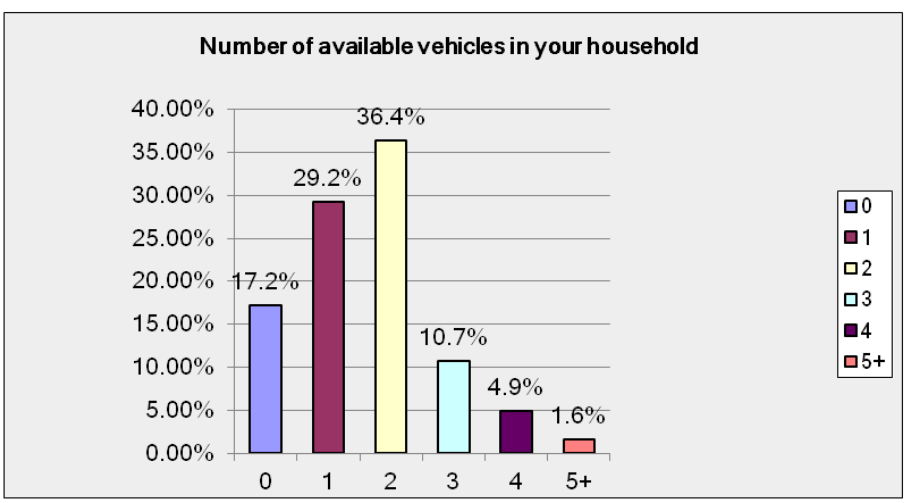


Figure 3.13. Question 28, "Number of available vehicles in your household."

The survey did not specify the type of vehicle. Vehicle availability per household is often associated with income, energy consumption, and residential density (Brownstone & Golob, 2009).

This study looked at income asking, "What is your approximate average household income?" (Figure 3.14). The highest response rate was the "$200,000 and up" category, 23.86% (73). High income correlated with the results of the vehicles per household question. Users with zero vehicles per household had an even distribution of average household income as is seen in Figure 3.15.

When users were asked about mode substitution, they responded as noted in Figure 3.16. As with other demographic groups in the study, personal car, and taxi again received the highest response rates. Users with five or more vehicles available most often replaced their personal car 80.00% (4) of the time. There is very strong evidence of a relationship between vehicles per household and transportation mode substitution (Chi-Square = 119.730, df = 40, $p < 0.001$).

Users were asked how many people, including themselves, were passengers in the DRS vehicle. Based on the number of available vehicles per household the respondents answered as in Figure 3.17. The response rate in the 5 or more category was once again very high with users reporting three or more passengers per vehicle, 60.00% (3). There was also evidence of a relationship between the number of vehicles available per household and number of passengers per vehicle (Chi-square = 27.608, df = 15, $p < 0.05$).

Question 10 asked DRS drivers to estimate the total monthly cost for gasoline, auto insurance, car payment, maintenance, tolls, and parking. The highest response rate was reported in households with five or more vehicles available, 40.00% (2) (Figure 3.18). Also, there was very strong evidence of a relationship between vehicles per household and the DRS driver's cost for vehicle maintenance (Chi-square = 74.158, df = 25, $p < 0.001$).

Not owning a car was predictably rated "Most significant" on a Likert scale to users in households with zero vehicles available, 56.60% (30) (Figure 3.19). Users who were DRS drivers were given the opportunity to opt out of this question. Thus, there was very strong evidence of a relationship between zero vehicles available per household and not owning a car when choosing to use DRS (Chi-square = 134.460, df = 25, $p < 0.001$).

3.3.8 Demographic comparison based on employment status

When users were asked about employment status, they responded as in Figure 3.20. The majority of respondents reported being employed full time, 74.35% (229).

3.3.9 Demographic comparison based on enrollment as a student

User were asked about their status as a student (Question 30) and reported as in Figure 3.21. The overwhelming majority reported they were not currently enrolled as a student, 84.09% (259).

3.3.10 Demographic comparison based on principal industry of employment

When users were asked about their principal industry of employment, they responded as in Table 3.4. Four industries were dominant among DRS users: Advertising and marketing, 4.56% (14), Education, 9.77% (30), Nonprofit, 7.82% (24), and Telecommunications, Technology, Internet, and Electronics, 12.70% (39). When asked in Question 5, "How long have you been using dynamic ridesharing?", all four of the principal, dominant industries gave high response rates to six months to one year, and more than one year. There is evidence of a relationship between the principal industry of employment and the length of time one uses a DRS service (Chi-square = 109.579, df = 80, $p < 0.05$).

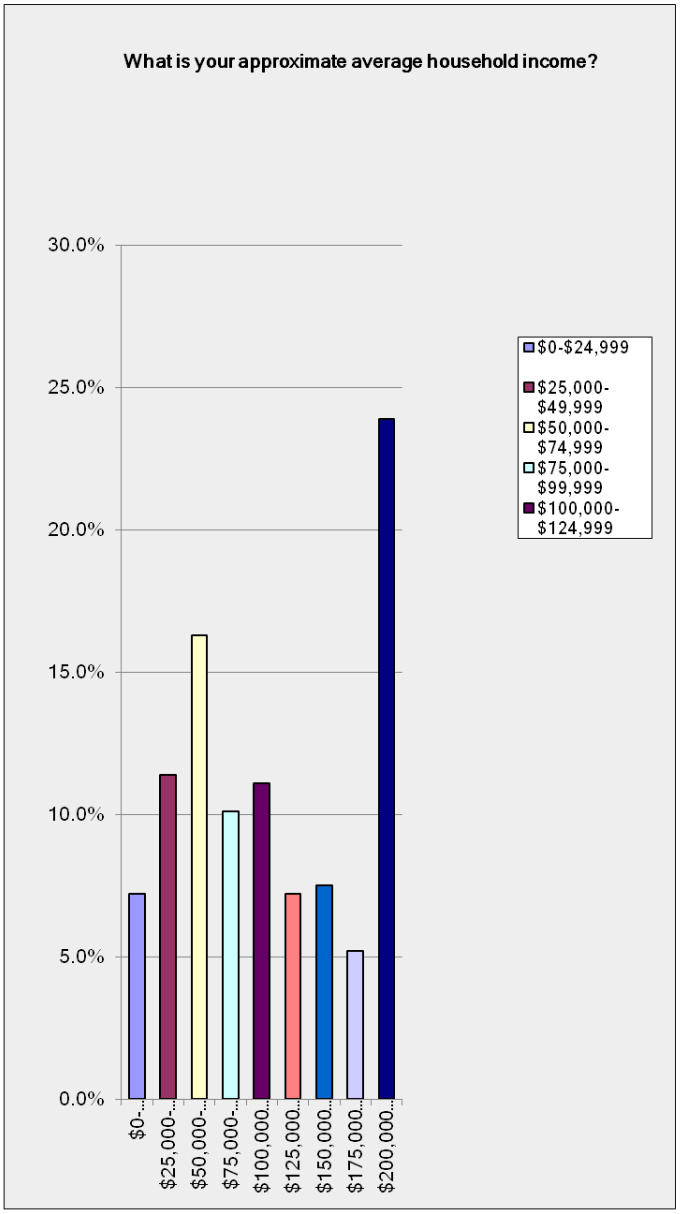


Figure 3.14. Question 32, "What is your approximate average household income?"

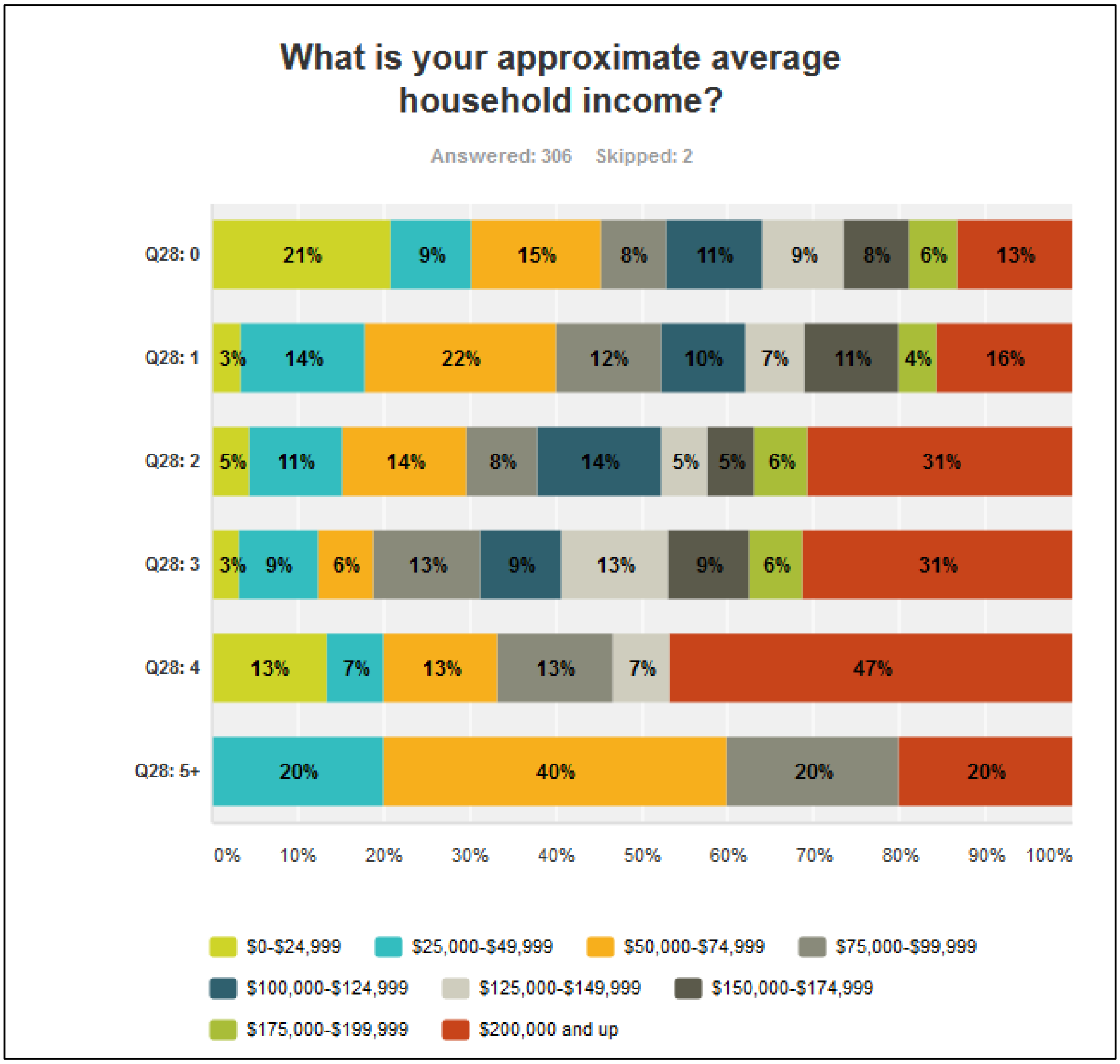


Figure 3.15. Vehicles per household compared with Question 32 "What is your approximate average income?"

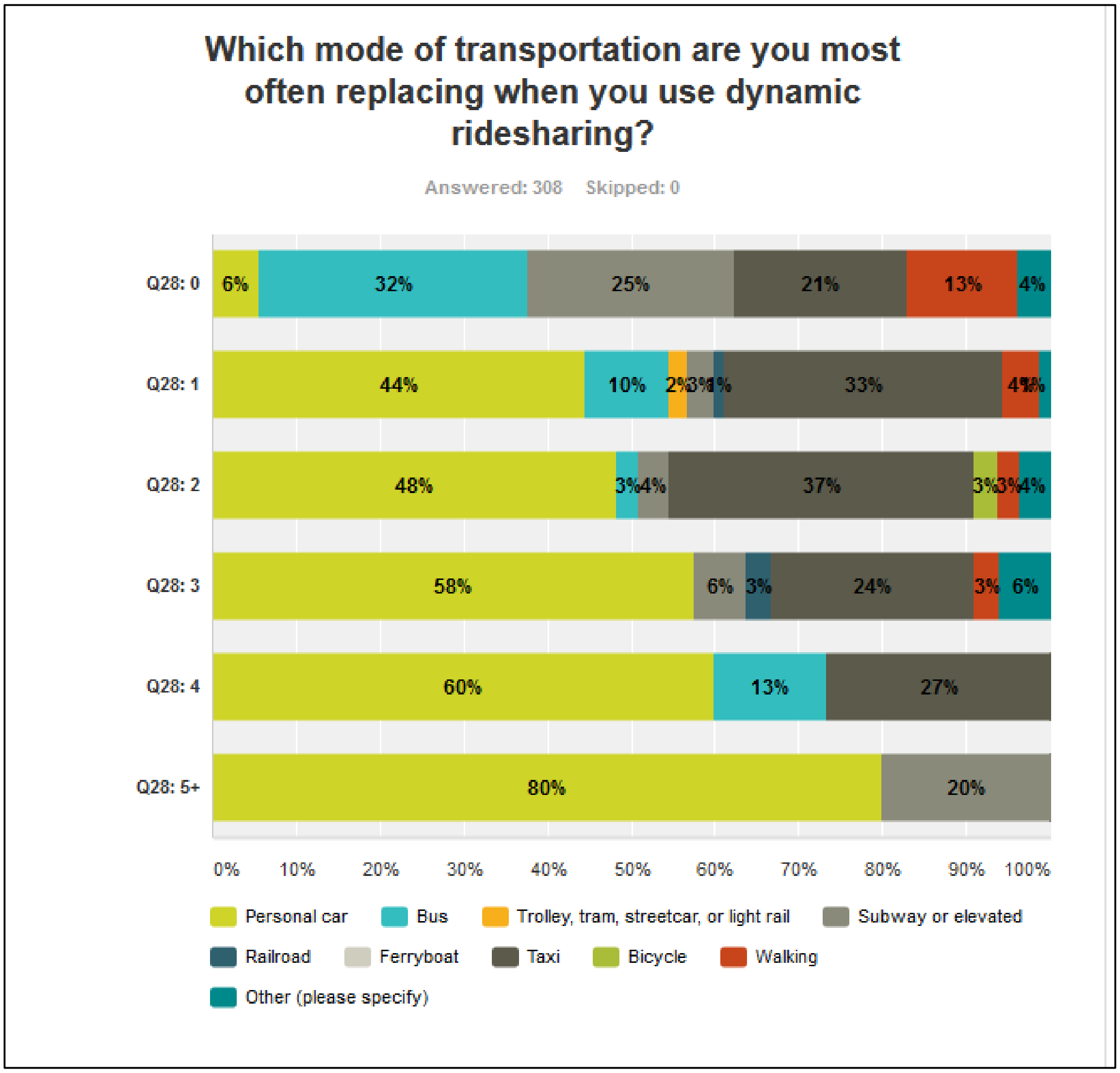


Figure 3.16. Number of available vehicles per household compared with Question 7 "Which mode of transportation are you most often replacing when you use dynamic ridesharing?"

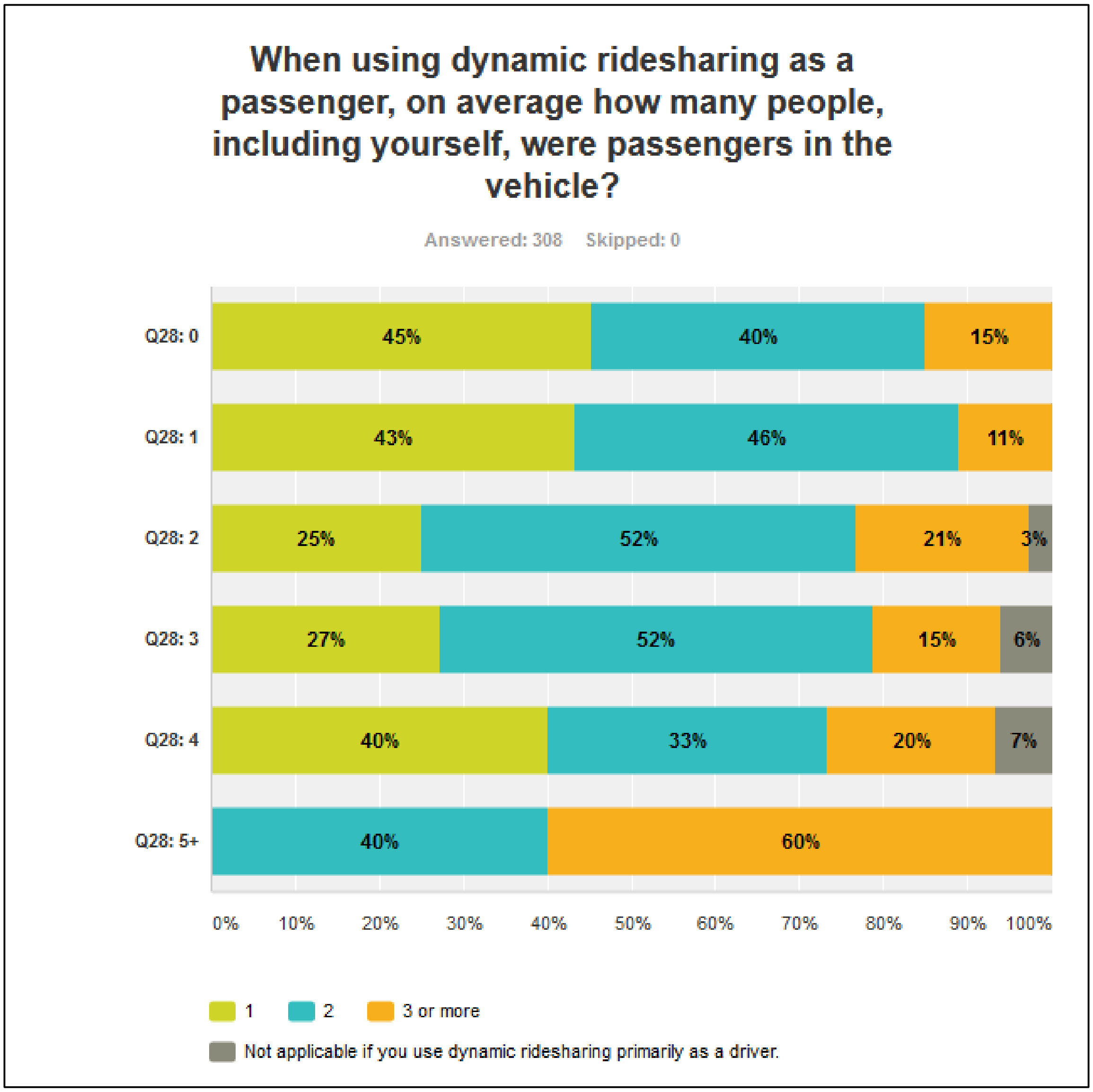


Figure 3.17. Number of vehicles per household (Question 28) compared with Question 9 "When using dynamic ridesharing as a passenger, on average how many people, including yourself, were passengers in the vehicle?"

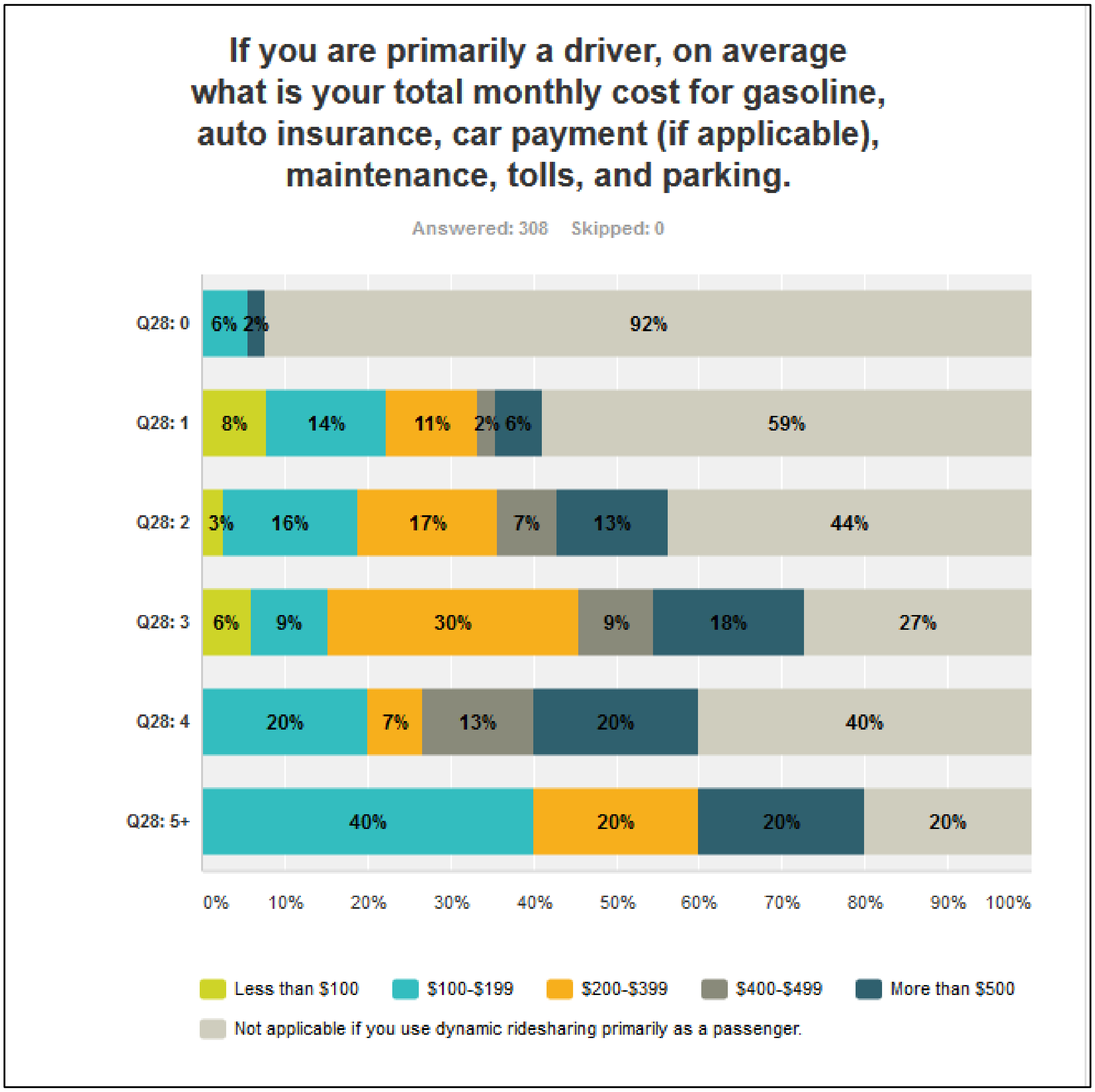


Figure 3.18. Number of vehicles per household (Question 28) compared with Question 10 "If you are primarily a driver, on average what is your total monthly cost for gasoline, auto insurance, car payment (if applicable), maintenance, tolls, and parking."

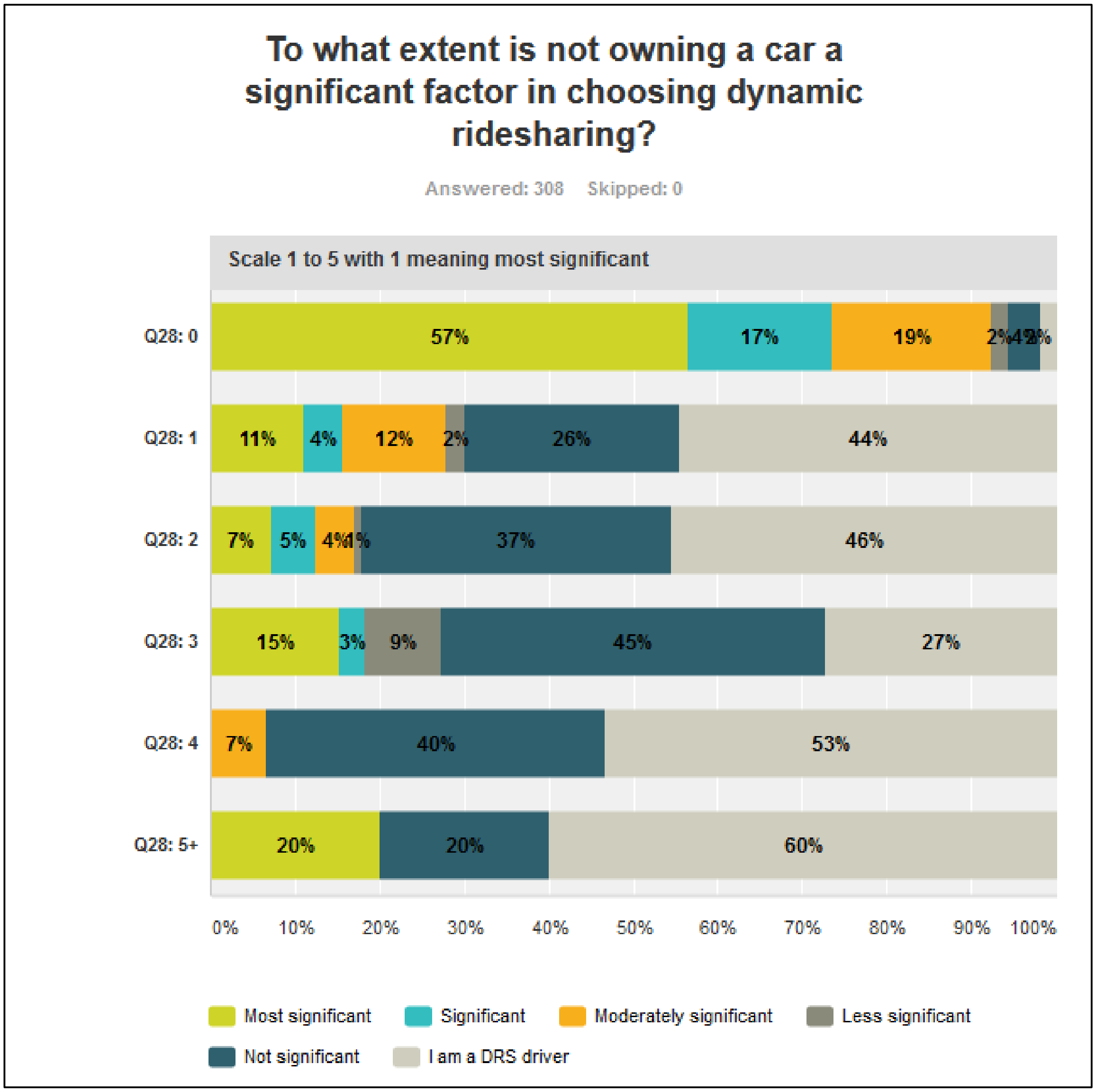


Figure 3.19. Number of vehicles per household (Question 28) compared with Question 15 "To what extent is not owning a car a significant factor in choosing dynamic ridesharing?"

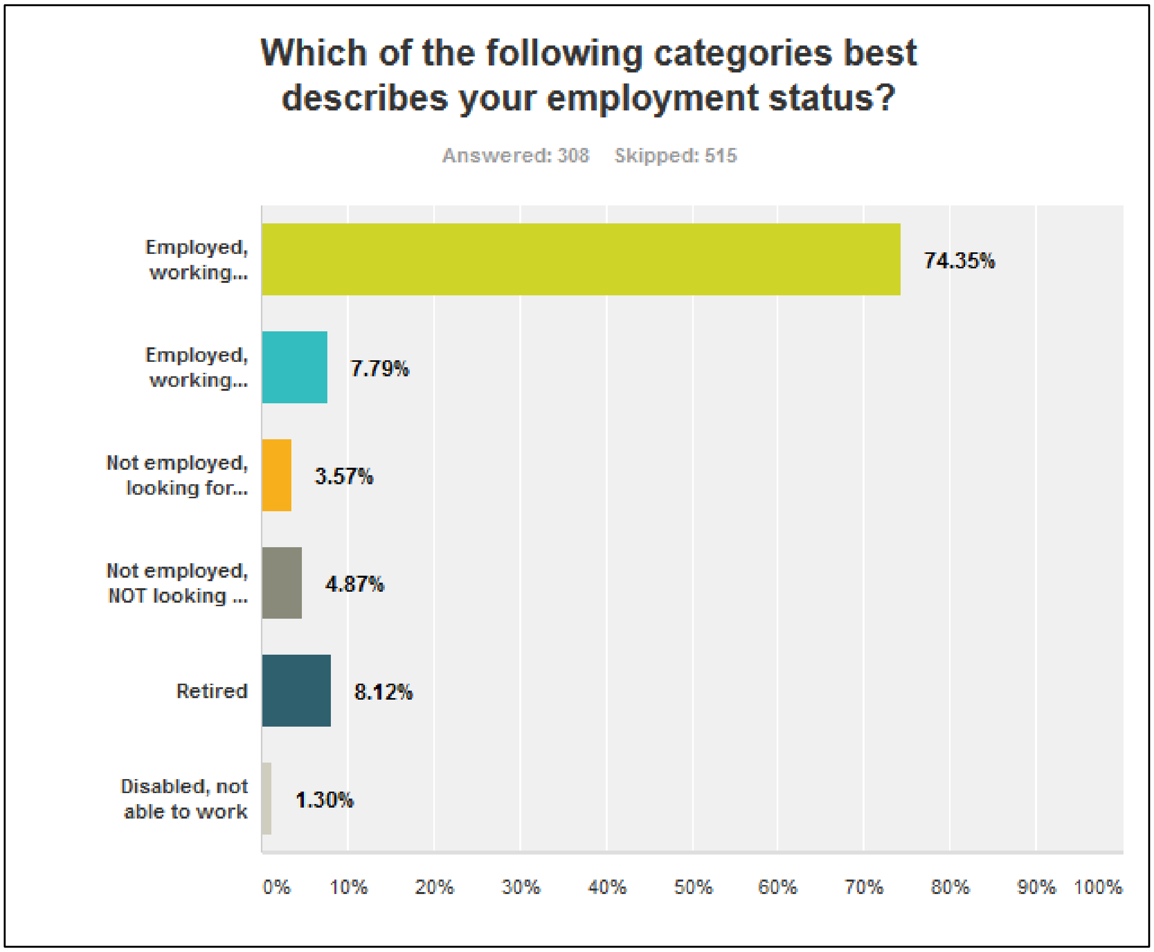


Figure 3.20. Question 29, "Which of the following categories best describes your employment status?"

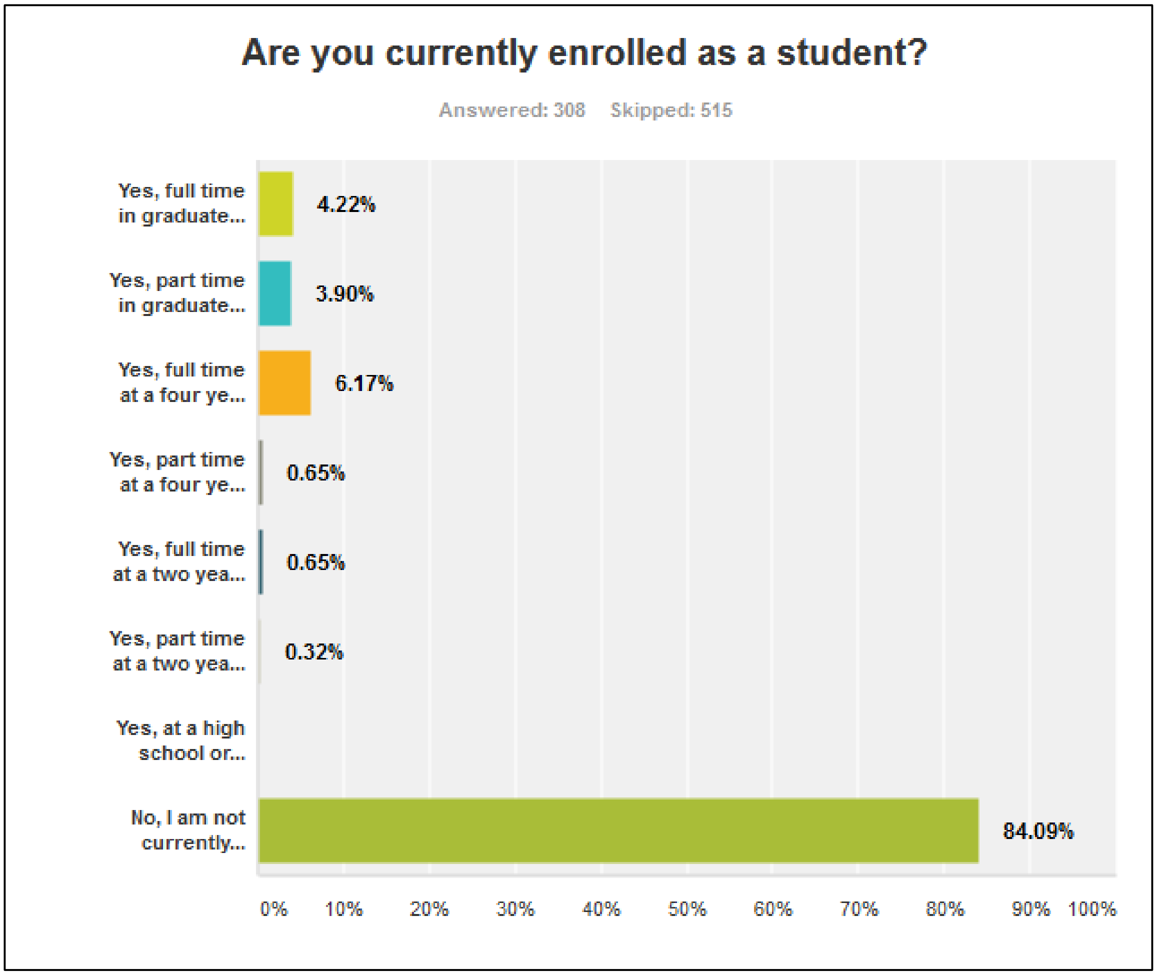


Figure 3.21. Question 30, "Are you currently enrolled as a student?"

Table 3.4:

Which of the following best describes the principal industry of your employment?

Answer Options	**Response Percent**	**Response Count**
Advertising & Marketing	4.6%	14
Agriculture	0.0%	0
Airlines & Aerospace (including Defense)	1.0%	3
Automotive	0.3%	1
Business Support & Logistics	3.3%	10
Construction, Machinery, and Homes	1.6%	5
Education	9.8%	30
Entertainment & Leisure	2.9%	9
Finance & Financial Services	7.2%	22
Food & Beverages	2.6%	8
Government	2.0%	6
Healthcare & Pharmaceuticals	9.1%	28
Insurance	1.6%	5
Manufacturing	3.3%	10
Nonprofit	7.8%	24
Retail & Consumer Durables	2.9%	9
Real Estate	2.0%	6
Telecommunications, Technology, Internet & Electronics	12.7%	39
Transportation & Delivery	1.6%	5
Utilities, Energy, and Extraction	1.0%	3
I am currently not employed	8.1%	25

Other (please specify)	14.7%	45
	answered questions	**306**

N = 306

3.3.11 Demographic comparison based on US region

The DRS survey was divided into nine US regions (Figures 3.23 & 3.23):

1. New England (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut)
2. Middle Atlantic (New York, New Jersey, Pennsylvania)
3. East North Central (Ohio, Indiana, Illinois, Michigan, Wisconsin)
4. West North Central (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas)
5. South Atlantic (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida)
6. East South Central (Kentucky, Tennessee, Alabama, Mississippi)
7. West South Central (Arkansas, Louisiana, Oklahoma, Texas)
8. Mountain (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada)
9. Pacific (Washington, Oregon, California, Alaska, Hawaii)

As a demographic group, DRS users by US region are represented in the bar chart in Figure 3.24 The Pacific region represents the largest cohort with 28.53% (214) user. The Eastern Seaboard combined (regions 1, 2, and 5) the most users, 38.54% (289).

When users were asked how long they used DRS, almost all regions gave the highest response rate to "More than one year". Only the West South Central region divided between "Less than one month" and "More than one year", 28.57% (4) each respectively (Figure 3.24).

When users were asked "Which mode of transportation are you most often replacing when you use dynamic ridesharing?", they responded as in Figure 3.26. Two regions, South Atlantic and East South Central more than any others used DRS to substitute their person car, 59.62% (31), and 66.67% (6) (Figure 3.25). There was strong evidence of a relationship between US region and mode of transportation substituted for DRS (Chi-Square = 96.316, df = 64, $p < 0.05$).

Users were asked “To what extent is reducing impacts on the physical environment a significant factor in choosing dynamic ridesharing?" and they responded as in Figure 3.26. The regions that gave the highest response rates of "Moderately important" on the Likert scale were New England, West North Central, South Atlantic, and Middle Atlantic, 47.06% (8), 37.50% (6), 32.69% (17), and 29.27% (12) respectively. The region that cared the least about the environmental significance of choosing DRS was the Mountain region, rating it as "Not important", 50.00% (9).

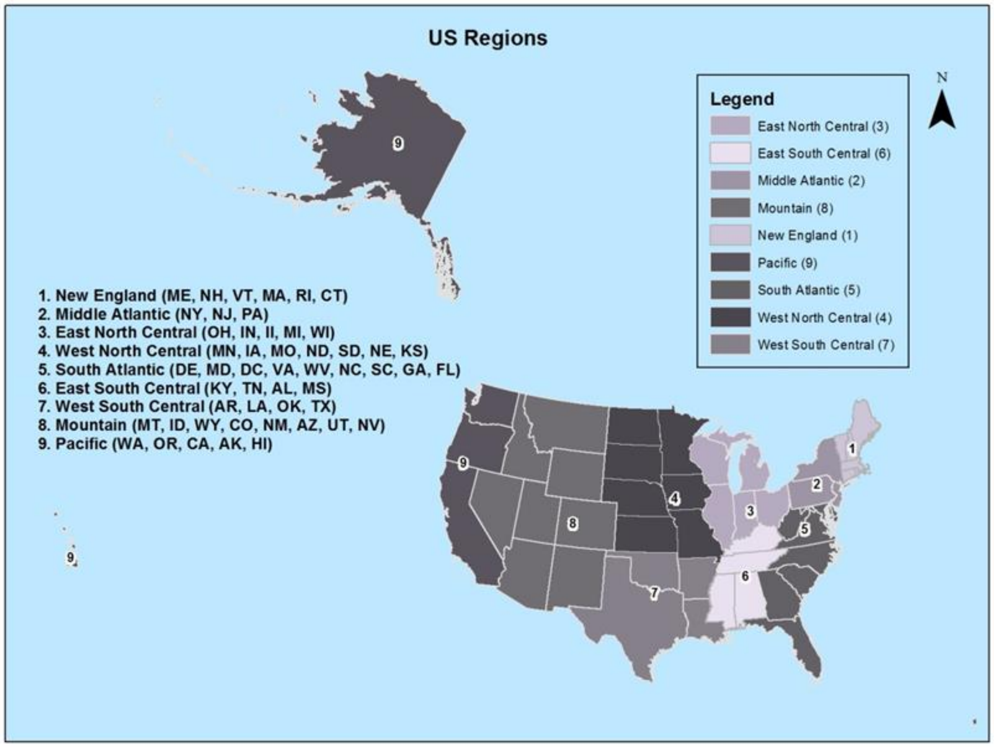


Figure 3.22. Respondents were divided into nine US regions.

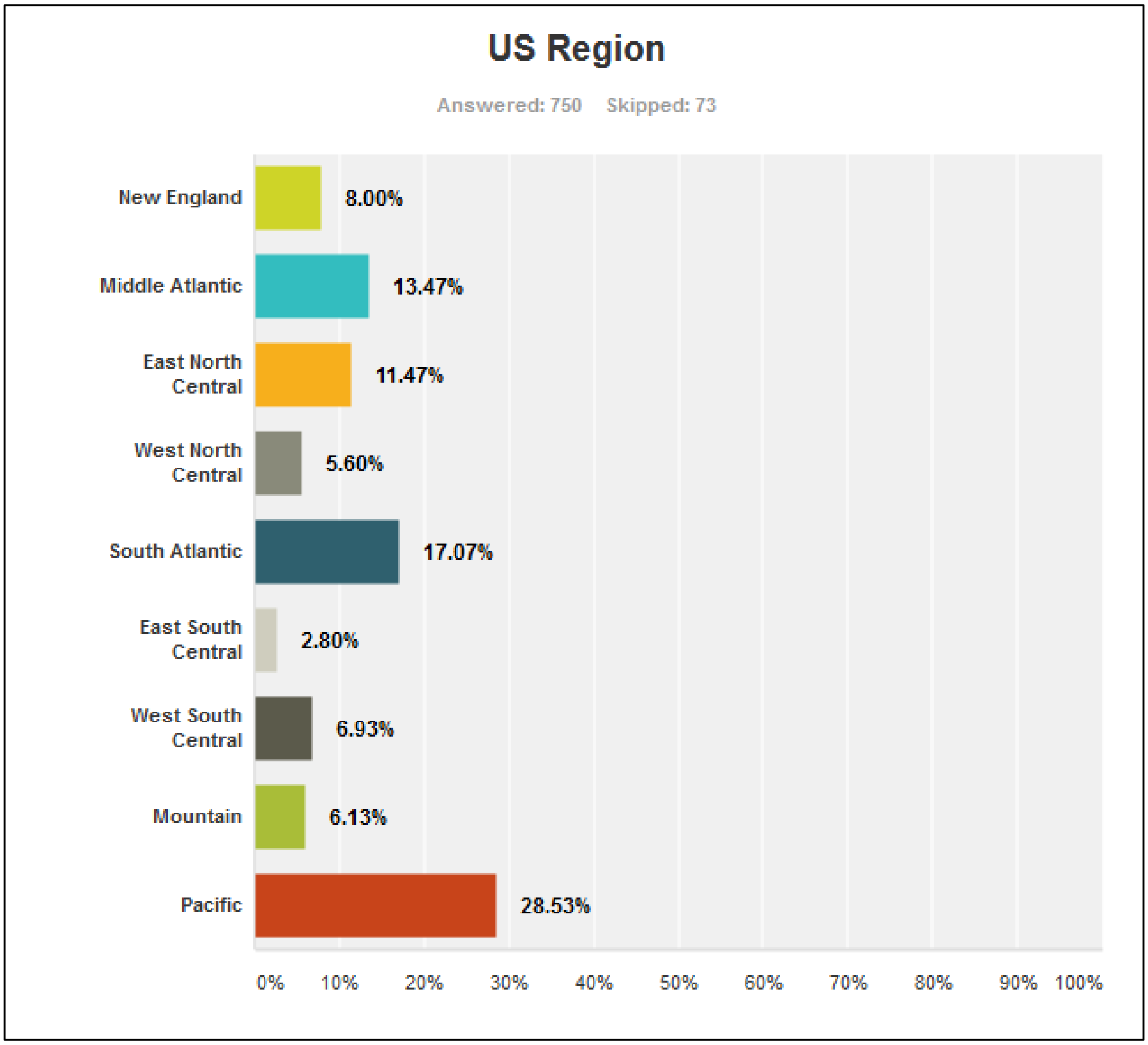


Figure 3.23. Respondents were representative of nine US regions

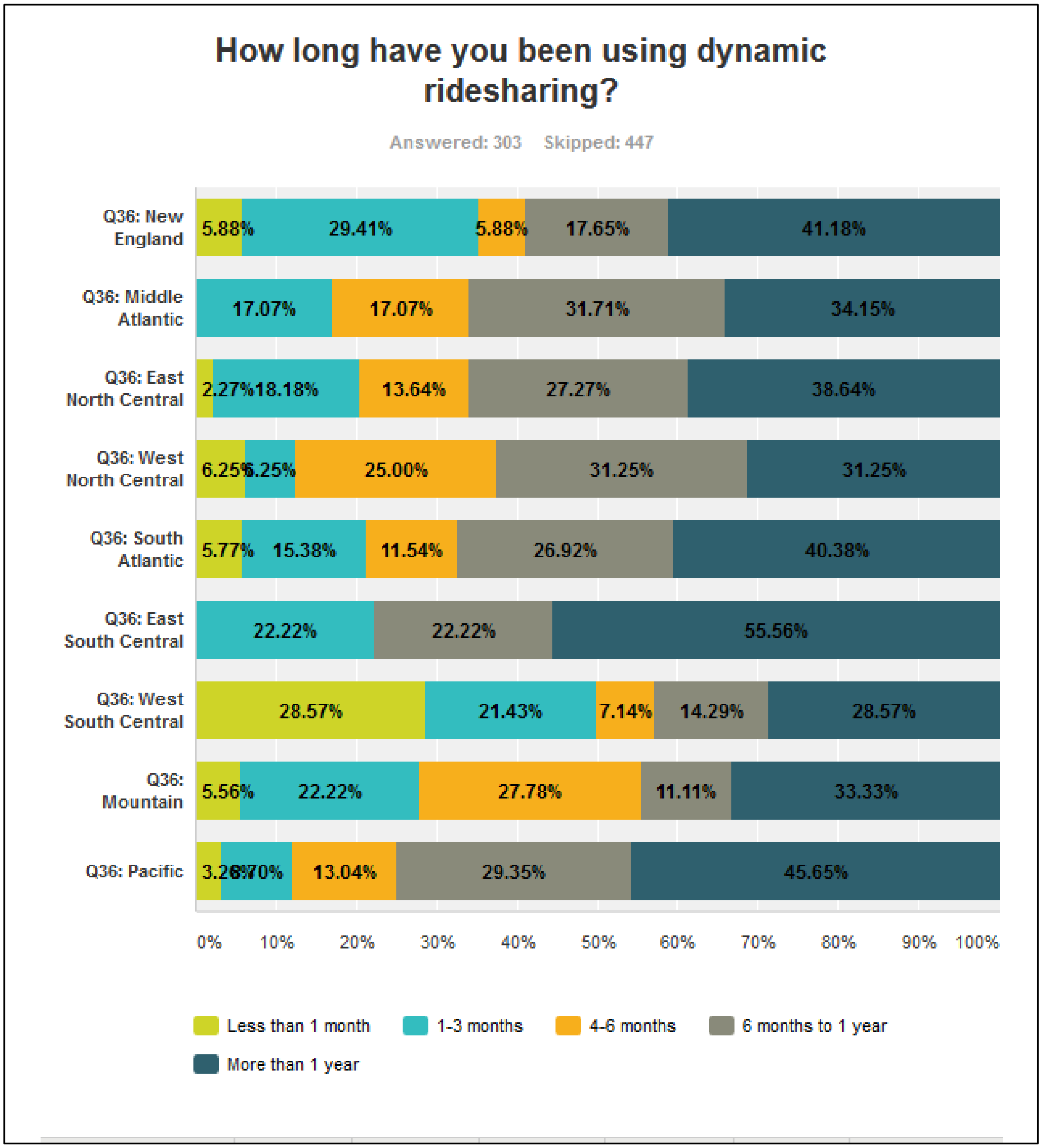


Figure 3.24. US region compared to Question 5, "How long have you been using dynamic ridesharing?"

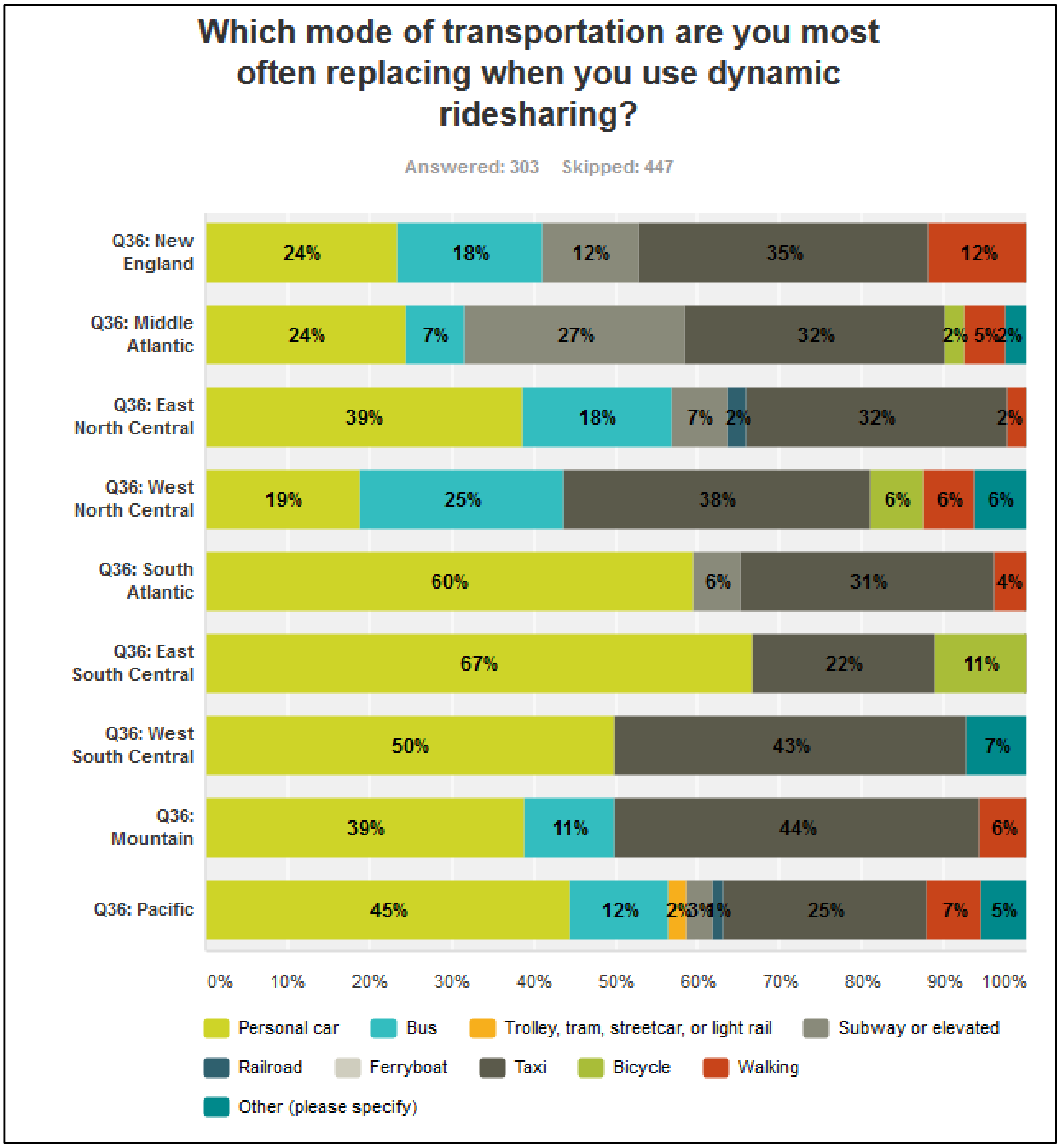


Figure 3.25. US region compared to Question 7, "Which mode of transportation are you most often replacing when you use dynamic ridesharing?"

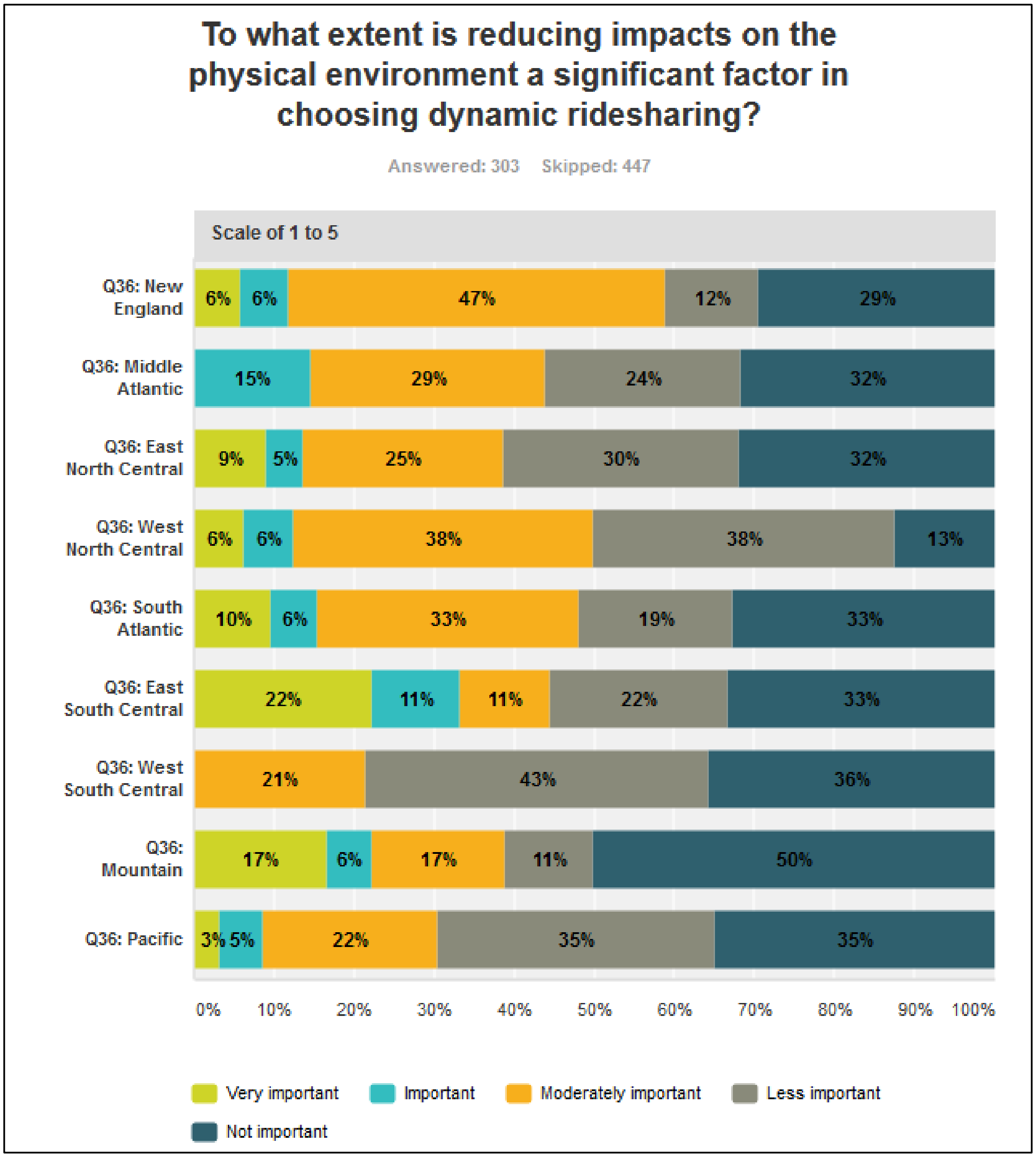


Figure 3.26. US region compared with Question 16, To what extent is reducing impacts on the physical environment a significant factor in choosing dynamic ridesharing?

3.4 Conclusions

As shown in the analysis of the demographic groups, the data indicated statistically significant differences among subgroups were compared to hypothetical situations regarding the current state of DRS. Many of these differences, however, were based on small segments of subgroups, some representing 1 to 5 respondents out of the total sample. Thus, these smaller differences are not likely to yield practical suggestions for further implementation or improvement of DRS. Additional research with more focused survey questions and a larger sample can assist in providing more conclusive results.

From the data, several assumptions could easily be hypothesized regarding the demographic profile of a typical DRS user. Although some real differences exist, it is obvious that many subgroups were not different. This suggests that the different demographic subgroups shared similar evaluations of DRS. Below are some implications of the demographic results and how they can be interpreted for further research.

3.4.1 Implications regarding the race subgroup

Overall, the ethnicity of the sample was predominately White, 90%, (271). There was some significant response rate from the Asian and multiple races subgroups, 4.55% (14) and 6.49% (20) respectively. The strikingly low representation of African-Americans in the sample, 0.97% (3), would suggest additional research.

Based on the results of this survey, the overwhelmingly White representation supports anecdotal evidence suggesting DRS drivers are statistically more likely to be White than traditional urban taxi drivers. The author tested UberX while at a conference in Chicago during the spring of 2015. UberX was used to make three local trips: two within the city, and one to the airport. All UberX trips were in vehicles driven by what appeared to be people of European or South Asian ancestry. UberX vehicles are not easily identified with external graphics; however, traditional taxis in Chicago bear the usual markings of the company and the fact that it is a vehicle for hire. Based on a non-representative visual sample, traditional taxis were predominately driven by people who appeared to be of East Asian or Sub-Saharan African ancestry. These casual observations are not suggested to be rigorous scientific analysis. However, they do provide a basis for future research.

3.4.2 Implications regarding the age subgroup

The data suggested that DRS users tend to be "millennials" or people born between 1980 and 2004. As a single cohort, 18 to 34-year-olds represented 47% (144) of the respondents. What is significant regarding this cohort is the consumer research showing these respondents trending away from purchasing personal vehicles and shifting their focus instead to social media and its supporting technologies (Nelson, 2015). Further research needs to explore whether this shift is due to economic factors, such as a weak economy and high student loan debt, or if there is a fundamental change in progress towards car ownership

3.4.3 Implications regarding subgroup attitudes toward environmental benefits

The environmental benefits of DRS include less congestion and resource consumption due to more efficient use of vehicles. This aspect of DRS seemed to escape most respondents who tended to give negative response rates when asked if they included environmental benefits in their selection process of DRS. Previous research by Deakin, Frick, and Shively (2012) indicated that saving money and time were the primary decision factors for choosing DRS. Little has changed in this attitude since 2012, perhaps suggesting that DRS platforms may want to stress the environmental benefits of ridesharing in their promotional material. It is quite possible that he layman fails to make the rather complex transportation planning connections between utilizing as many seats as possible in a vehicle and the consequences of a national fleet comprised primarily of SOVs.

3.4.4 Implications regarding users' attitude towards public transportation

In Question 19, the majority of respondents rated DRS as a better option than public transportation. The highest response rate was "Better", 46.75% (144). The lowest response rate was "Not better", 2.60% (8). Considering that most DRS services need a densely populated area to work reliably, one can assume that most respondents lived in compact urban areas. The implication of the data's negative response towards public transportation reveals an overall failure of the national public transportation system. One could extrapolate from these results that DRS, implemented on a larger scale, could ultimately threaten the existence of public transportation as municipalities see ridership decline with DRS use. Already, automobile manufacturers are developing multi-passenger transport vehicles based on DRS principals (Badger, 2015). The Ford Motor company is currently experimenting with a van that is connected to a ridesharing app. The strategy for this is two-fold: anticipation of the decline in vehicle purchases by millennials and the eventual need by municipalities for a new public transportation vehicle that is responsive to users' input and more flexible in its destinations. The experimental vehicle called a "dynamic social shuttle) it is not being developed as a fixed-route system, but one that offers passengers direct door-to-door service.

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Chapter 4

Legal and Administrative Issues Affecting Dynamic Ridesharing Platforms in San Francisco and New York

Abstract

Dynamic ridesharing (DRS) platforms have been creating disruption in the urban transportation industry by offering both drivers and passengers attractive alternatives to traditional taxi and limousine services. Drivers are using it to earn income utilizing their personal vehicles. Passengers are attracted to the simplicity of summoning a ride with the touch of an icon on their smartphones. Other features, such as cashless payment, tipping included in the price, and seeing how soon your car will arrive in real-time on a smartphone map are among the other major features that have captured the attention of many urban dwellers. According to statistics gathered by the New York Tax and Limousine Commission the DRS platforms Uber now outnumbers all yellow medallion taxis (Pramuk, 2015).

Much of the success of DRS platforms, however, has been hard fought. In each city a DRS platforms enters, regulatory agencies grapple with protests from incumbent industries that stand to lose to the disruptors. In some cities, highly-valued classic taxi medallions, permits used to operate taxis and a method of regulation dating from the 1930s, are threatened with becoming obsolete.

This review examines a chronology of the legal and administrative challenges to DRS platforms in two premiere cities, San Francisco and New York. The cities each have their unique role in the disruption process and by comparing and contrasting events, a picture emerges of similarities and differences that provide the context for this new and complex transportation service.

Keywords: dynamic ridesharing, DRS, New York, San Francisco, disruption innovation, taxis, regulation, Uber. Lyft.

4. Introduction

Dynamic ridesharing (DRS) applications (APPS) such as Uber and Lyft have gained mass popularity in cities across the United States and globally. San Francisco and New York are not exceptions and were chosen for this study to compare the legal and administrative issues that DRS services faced in order to overcome resistance to competing stakeholders and prosper in these challenging urban environments. The cities for this review were selected due to their unique for-hire vehicle (FHV) histories. Due to the cities' statures as centers of innovation, (i.e. for San Francisco technological and for New York financial and cultural) the legal and administrative issues facing DRS providers are being watched carefully by all who have a stake in the operations of urban transportation. Their outcomes will possibly be precedents for the future direction of DRS. Thus, both cities can be viewed as test beds for the disruption of the transportation industry by DRS.

Historically, San Francisco's "taxi problem" can be traced to the political environment of the 1970s when organizations sought to deregulate many industries by removing government controls and handing much decision making back to the private sector. In San Francisco's case, this was to address perceptions of unfairness and corruption in the taxi industry (Newsham, 2000). In New York, regulation of the taxicab industry can be traced back to 1937 when then-Mayor Fiorello H. La Guardia signed the Haas Act. The law introduced licensing of taxis and the medallion system. The medallion, an aluminum plate affixed to the hood of a vehicle grants official status to the owner to use the taxi to transport passengers for a regulated fee. The number of medallions issued by the city was fixed then, as it still is in 2015, and can only be changed by the Taxi and Limousine Commission (TLC), the municipal agency that has jurisdiction over FHVs (Van Gelder, 1996; New York City Taxi and Limousine Commission, 2015). New York medallion prices rose to a high in late 2013, when two medallions were sold for $1 million each, the highest price recorded since they were issued in 1937 (Flegenheimer, 2013). As of 2015, medallion prices are dropping sharply to an average of $805,000, likely due to the launches of DRS services like Uber, Lyft, and SideCar (Barro, 2015) Some financial analysts have claimed that the medallion is becoming obsolete as DRS continues to disrupt in cities whose taxicab industry uses this system (Hickman, 2015; Barro, 2015). Fleet owners and private holders of taxi medallions have become concerned that the traditional FHV industry will cease to exist unless local and state governments step in immediately (Madhani, 2015). In light of this concern, there was reassurance offered from government sources such as New York TLC Commissioner Meera Joshi. Commissioner Joshi states that the core and the majority of passengers in New York will still choose hand-hailing (Caruthers, 2015). The commissioner bases evidence on her contention that the price of yellow taxi medallions is not tied to the health of the greater industry. She cites the increasing value of the large number of green all-borough[2]cabs as evidence that there is enough diversification within

[2] In 2013, the TLC introduced the Boro Taxi program that has licensed uniquely green colored taxis to serve areas of the city that have been commonly excluded by yellow medallion taxis. Green Boro Taxis service all of the five boroughs of New York except south of West 110th and East 96th Streets in Manhattan, and both La Guardia and John F. Kennedy International Airports in Queens.

the industry to absorb Uber and other DRSs without threatening yellow taxi medallions (Figure 4.1).

Figure 4.1: TLC authorized green all-boro taxi licensed to serve areas of New York normally excluded by yellow medallion taxis (Source: Author, 2014).

This study used primary and secondary sources from the internet to create a chronology of legal and administrative issues that could be compared and contrasted with each city. Similarities and differences among the issues exist for both San Francisco and New York.

4.1 Methodology and Data Gathering

The process of gathering the data for the chronology required the use of primary and secondary sources retrieved from Internet searches that were conducted for each of the case cities. Primary sources used to assemble the legal chronologies were mostly taken from blogs and legal documents. Secondary sources included pertinent press coverage in articles found in online versions of print newspapers, online news sources, online versions of news magazines, and other mass media such as online television or radio news programs.

4.2 San Francisco

4.2.1 Introduction

San Francisco's proximity to the Silicon Valley technopole has guaranteed its place as a center of disruptive innovation (Castells & Hall, 1994). From this region, companies have emerged that have left their imprint on society and business since the mid-twentieth century. Companies such as Apple, Hewlett-Packard, Xerox, eBay, etc., have each been instrumental in the disruptive innovation of long-term industries (Christensen, 2003). Its concentration of high-technology workers, Ph.D.s, and entrepreneurs makes it a logical origination point and birthplace for Internet-enabled and location-aware ridesharing services. San Francisco's role in the development of DRS is unique, yet as an originator the city has been a template for the global proliferation of companies like Uber and Lyft. For its foundational role, it was selected as the leading case study city for a chronological review of legal and major transportation issues affecting DRS.

The city's image of confident tech workers and cutting-edge services is a natural fit for DRS, which promises to be the new method of urban transportation for the coming century. That promise, however, has been impeded at times by parties whose established place in the urban transportation matrix is threatened by DRS.

4.2.2 Background

Prior to DRS's arrival in San Francisco in the form of Uber in 2009, and Lyft and SideCar in 2012, the city's traditional yellow taxi industry already had a long-standing reputation for poor and unreliable service. A brief review of San Francisco's taxi industry of the past 35 years will help to instruct why the citizens of this innovative city were eager to accept a new, untested model that would not only reform, but remake urban transportation.

The late 1970s were a time when deregulation of transportation industries were seen as a solution to problems inherent in these organizations. A major event of this period in history was the Airline Deregulation Act of 1978. The Act was a federal law designed to remove government control of the commercial aviation industry. Other transportation modes followed with their versions of laws calling for either deregulation or regulation. In the case of San Francisco, Proposition K arrived in 1978 and required that all taxis have permits issued only to natural individuals and in one name only (Charter Reform Working Group, 2007). Proposition K also imposed a driving requirement so that only working taxicab drivers could hold permits.

Hence, the history of the San Francisco's "taxi problem" can be traced to the year 1978 when ballot initiative Proposition K was passed to correct perceptions of unfairness and corruption within the industry (Newsham, 2000). Under Proposition K, the city of San Francisco would issue taxi medallions to persons paying an annual fee (San Francisco Municipal Transportation Agency, 2014). The taxi medallions used as operating permits was an old concept dating back to 1937 in New York (Van Gelder, 1996). Under Proposition K's medallion system, the owner leases it to an experienced taxi driver who uses it to generate income. The arrival of Proposition K also placed a limit on the number of medallions that could be authorized at any time. Limits on the number of medallions were gradually increased to keep pace with demand, however, as late as 2014, San Franciscans were still complaining about the difficulty of ordering a taxicab (Said, 2014).

According to Newsham (2000), the medallion system implemented in 1978 was an attempt to discourage speculators from bidding up the prices of medallions. Thus, medallions were only awarded to individuals who would rent taxis from established firms rather than hold on to them for financial speculation. Although Proposition K's original intent was to protect workers by removing medallions from speculators, other problems were unmet. Since 1978 taxi drivers had been operating as independent contractors of the established cab companies. This system ensured income for the cab companies who were paid by drivers to lease taxicabs. Thus, the cab company was guaranteed an income regardless of the amount or lack of money generated by the cab during the driver's shift. Cab companies also benefited from the independent contractor relationship with drivers because they were relieved of paying social security and disability taxes and were shielded from the threat of unionization (Newsham, 2000). These were all items that would normally be required of companies when workers are actual employees. For most of the drivers, independent contractor status was seen as a benefit that freed them from direct supervision by supervisors and granted them the ability to work the hours they preferred (Newsham, 2000). Under the Proposition K system, however, the seeds of the San Francisco taxi problem were planted. Passengers suffered most from this system because there were no rules or regulations that explicitly required enough drivers to be available at any given time. Requests for drivers would be broadly transmitted across the city regardless of the driver's distance from a waiting passenger, or whether his or her taxicab was on-duty and unavailable. Also, drivers determined their schedules and could decide to end a shift and not accept a passenger's request.

The flawed system introduced in 1978 with Proposition K deprived San Francisco's taxi patrons of reliable service for many decades. Attempts at reform were often favored by medallion owners and taxicab companies instead of passengers. With this background, it is clear to see how DRS arrived in San Francisco and was immediately embraced by the public. The entrepreneurs behind the launches of DRS platforms in San Francisco were aware of the "taxi problem" and applied the new enabling technologies that brought improved service to the city. It is worth noting, however, that the issue of independent contractor status has returned with the arrival of Uber, Lyft, and SideCar, (Wood, 2015). Recent developments involving DRS drivers will be examined in the section on the chronology of legal issues. The following section summarizes legal and major transportation issues that affect the operation of DRS in San Francisco. Following San Francisco, there will be a chronological review of DRS issues in New York.

4.2.3 Chronology

San Francisco Metro Transit Authority and the California Public Utilities Commission order UberCab to cease and desist, October, 2010. Uber was launched in San Francisco in June 2010 under its original name, UberCab. The legal issue cited, a regulatory action initiated jointly by two government agencies is one of the earliest legal actions taken against the young company. On October 19, 2010, UberCab received a cease and desist letter issued jointly by the San Francisco Transit Authority (SFMTA) and the California Public Utilities Commission. An order of cease and desist is a legal document sent to an entity, in this case, a business, instructing them to stop allegedly unlawful activity and no to longer take up the activity again. A deadline usually accompanies the cease and desist document warning the company that failure to comply will result in a penalty, such as being sued (Legal Information Institute, 2015). The unlawful activity alleged was the operation of a taxi-like business without a license and not providing insurance equivalent to a commercial taxi's insurance (Kolodny, 2010).

UberCab's chief executive at the time, Ryan Graves, responded to the legal document by saying that the company believes it is offering a service in compliance with the alluded to regulations. UberCab contended that they were offering an innovative new form of transportation technology that the SFMTA and CPUC have not yet been able to evaluate for the purposes of regulation. Graves offered to educate the agencies to forge new sets of regulations based on the technology offered. Despite Graves' offer to educate, UberCab was still perceived by those outside the technology industry as a company that operates similarly to a taxicab cab, but without the required license and insurance (Siegler, 2010). It was during the time of this particular cease and desist letter that the company changed its name from UberCab to simply Uber to circumvent association with the traditional taxi industry (Kolodny, 2010)

CPUC enters into operation agreement with Uber, December 2012. On December 12, 2012, the CPUC issued a statement and said it would evaluate DRS services like Uber. The proceeding was intended to protect public safety and to encourage technological innovation in urban transportation (California Public Utilities Commission, 2013). This action by the state regulatory agency set in motion the eventual acceptance and regulation of DRS as a valid alternative transportation mode. It was in 2013 that the CPUC would eventually draft rules that defined periods when a DRS service handled providing insurance and when a driver's insurance would take effect. This period would also lead to definitions regarding inspections of vehicles and background checks on drivers. With this initial agreement by the CPUC, cease and desist notices to Uber were suspended pending the outcome of the agency's rulemaking (California Public Utilities Commission, 2013a).

Uber drivers file a class-action lawsuit alleging that Uber cheats them out of tips. August, 2013. Although there was a case settled in June of 2015 where a California judge determined that Uber drivers were employees of the company and not independent contractors, in 2013 the independent contractor status of drivers was accepted as the relationship drivers had with a DRS platform . Back then, as now, drivers depended on the DRS's app to collect fares and reimburse them minus the administrative fee that was typically 20% (Hubpages, 2014). The remaining 80% of the fare was deposited into a bank account designated by the driver. Uber stated that tips to the driver were calculated into the fare so that passengers can simply use the phone app and avoid handling cash (Brustein, 2013). However, in the a class-action lawsuit filed in California in August, 2013, drivers had alleged that Uber keeps prices artificially low as a way to compete with other platforms, thus depriving them of tip-income they would normally collect as traditional taxicab drivers. This lawsuit also alleged that Uber drivers are employees rather than independent contractors. See also the heading "Uber Technologies v. Barbara Berwick, Jun 2015" where an Uber driver was successful in securing a ruling from the California Labor Commission stating that she was, in fact an employee of the company. The ruling in her favor required Uber to pay her for business expenses she during the two months she was a driver for Uber (Huet, 2015).

CPUC established rules for DRS service and created a new regulatory category called Transportation Network Companies, September, 2013. DRS platforms were beginning to become ubiquitous by 2013. Uber, Lyft, and SideCar were expanding in cities across the United States. Uber's expanded internationally with a 2011 launch in Paris, France. UberX was launched in 2012 in San Francisco and New York initially focusing on smaller hybrid cars. UberX is a non-black car version of Uber specifically designed for competition with the other lower-cost rideshare platforms (Gannes, 2012).

Government regulators were often encountering situations with DRS services where no rulings existed due to the newness of the mode.

In San Francisco on September 19, 2013, California became the first U.S. state to regulate DRS services with a ruling issued by the CPUC (California Public Utilities Commission, 2013b). The regulatory model created by the CPUC has become a template emulated by many DRS services in other U.S. states. The ruling made DRS platforms such as UberX, Lyft, and SideCar subject to CPUC jurisdiction. As a result of the regulation, a new category for DRS platforms was created called Transportation Network Company (TNC). TNCs were defined as DRS services that used smartphones and Internet technology to match riders with drivers (California Public Utilities Commission, 2013b). The CPUC also set mandatory rules on driver and criminal background checks for drivers who register with a TNC.

Much needed clarification on insurance was offered by the new CPUC rules. The regulatory body set three "defined periods" to help clarify when insurance applies Period One is "App open-waiting for a match"; the driver is in his/her vehicle and turns on the app. Period Two is "Match is accepted- but the passenger is not yet picked up"; the driver is on his/her way to retrieve the passenger. Period Three is "Passenger in the vehicle and until the passenger safely exits vehicle". The CPUC wanted to ensure

Table 4.1: Summary of CPUC insurance regulations for TNCs (California Public Utilities Commission, 2013c).

State of mobile device			CPUC defined insurance coverage	UberX	Lyft	SideCar
Not logged on/ not available		app off	Driver's personal auto insurance			
Logged on/ Not on trip	Period 1	app on	Driver's personal insurance, PLUS- Contingent liability coverage (also called "insurance gap" coverage (1)	X	X	X
Logged on/ driver accepts trip	Periods 2 & 3	app on	TNC must provide primary commercial insurance in the amount of one million dollars. This may be satisfied by TNC if: (a)commercial insurance is maintained by driver (2); (b) commercial insurance maintained by the TNC; or (c) a combination of (a) and (b)	X	X	X
Logged on/ during trip/ when trip ends	Period 3	app on	TNC must provide uninsured (UM) and underinsured (UIM) insurance in the amount of one million dollars. This may be satisfied by TNC if: (a)commercial insurance is maintained by driver (2); (b) commercial insurance maintained by the TNC; or (c) a combination of (a) and (b)	X	X	X

1. TNC provides contingent liability coverage if/when driver's personal auto insurer denies
2. TNC must verify that the driver's insurance covers the vehicle for TNC purposes

there were no insurance gaps when drivers were getting paid to give rides and achieved this with the new regulations (G. Mathieux, personal communication, October 9, 2014).

Despite the legal acceptance of TNCs throughout California's cities and some jurisdictions throughout the United States, airports have stood vehemently opposed to TNC operations on airport property. Their hesitancy ostensibly stems from a concern about additional traffic congestion at airports. Some TNCs, such as Wingz, circumvent the airport issue since they do not use a smartphone app, but instead accept reservations for airport pickups and drop offs through their website only. The CPUC and the City of San Francisco recognize that web-based companies such as Wingz historically had customers reserve rides via the web. Thus, web-based platforms such as Wingz are exempt from the Period One and Period Two phases of insurance coverage. However, web-based TNCs are required to provide coverage for defined Period Three. Defined period three is when the passenger enters the vehicle and until he/she safely exits (G. Mathieux, personal communication, October 6, 2014). Allowing TNCs to enter most U.S. airports is still being negotiated at the time of this writing.

Family sues Uber for wrongful death, January, 2014. On December 31, 2013, a six-year-old girl, Sofia Liu, was struck and killed by an UberX driver in a San Francisco crosswalk. In January, 2014, the girl's family filed a lawsuit against both the driver and Uber Technologies, the parent company of UberX (Levine, 2014). The lawsuit contended that the driver was logged on to the UberX app and was waiting to receive a ride request from a potential passenger. This allegation would place him in Period 1 of the CPUC's newly defined insurance requirements for TNCs. According to the CPUC's definition of Period One, the TNC, in this case, UberX, would be required to provide insurance (Williams & Alexander, 2014). The driver of the UberX vehicle has claimed that he had the app on and was waiting for a ride match. However, Uber claims that the they are not liable because the driver was an independent contractor and not an employee. Uber further claims that the driver was not carrying a fare or going to pick up a fare and had no reason for his smartphone app to be open (Williams, 2014).

California regulators and the National Federation of the Blind investigate claims that DRS drivers refuse rides to passengers with service animals, May, 2014. The

CPUC, the state regulatory body that acquired jurisdiction of DRS services as of September, 2013, and the SFMTA, the municipal agency with jurisdiction over the city's taxicabs, joined with the National Federation of the Blind to investigate claims that DRS drivers, and Uber in particular, were refusing rides to blind passengers with service animals. A major problem for DRS services has been their avoidance of the issue of how to handle passengers who are disabled. Traditional carriers often point to this issue as an area where companies like Uber and Lyft are benignly excused by regulators from providing accommodation for passengers with special needs (Farr, 2014). Until this event, regulators had been lax in enforcing discrimination under the laws of the Americans with Disability Act of 1990 (ADA). This investigation would eventually lead to a lawsuit filed in May 2015. See heading " Disabled groups suing Uber and Lyft, May, 2015" in this section.

San Francisco's District Attorney's office files lawsuit against Uber, Lyft, and SideCar for alleged unlawful business practices, December, 2014. (unlawful business practices/background checks, illegal fees) The district attorneys of San Francisco and Los Angeles sued Uber over alleged unlawful business practices that included charging passengers a $4 fee that was meant to cover fees for passengers traveling to the airport. Other carriers charge a similar fee that is ultimately collected by the airport. The lawsuit alleges that Uber has been charging the fee and pocketing it rather than forwarding it to the airport (Roberts, 2014).

In the lawsuit, Uber is also charged with being out of compliance with regards to performing adequate background checks on potential drivers. By law, Uber cannot deny access to their platform by drivers who have been convicted of a felony beyond seven years into the past (Macmillan, 2014) Lyft reached a settlement with prosecutors and agreed to it would wait until the necessary permits and approvals were issued to resume picking up passengers at the airport (Lien & Mitchell, 2014).

Some still buy San Francisco taxi medallions, January, 2015. While medallion prices fall nationally due to DRS services like UberX and Lyft, some still see the medallion as an investment that is worth buying at low prices. According to San Francisco cab driver, Gerard Rowland, medallion prices had fallen in the past when new transportation projects open, such as the BART urban rail system that began service in 1972. Medallion prices in San Francisco by the SFMTA. As in New York, medallions in San Francisco grant the owner the right to operate a taxicab either by themselves or by renting it to other drivers or taxicab companies (Said, 2015).

Disabled groups were suing Uber and Lyft, May, 2015. Uber and Lyft, the two major DRS services, were named as defendants in lawsuits filed in both California and Texas. The lawsuits illustrate the lack of training that DRS drivers received, especially with regards to regulatory issues such as being knowledgeable about the laws regarding ADA compliance. The California lawsuit was brought by the National Federation of the Blind. The lawsuit describes an incident such as an UberX driver who placed a blind passenger's guide dog in the trunk of the vehicle. (Wieczer, 2015). Uber states that independent contractors who drive for their platform can transport blind or other disabled passenger and that drivers who refuse such passengers are usually suspended. Lyft offered a similar policy and added that drivers who refuse service animals must call a special hotline number and have a medically verified reason for refusal. Without medical documentation, Lyft's policy is similar in that refusal will result in suspension. Suspension in the case of DRS platforms means that the driver loses access to the app. The DRS services are careful to avoid wording that implies an employer/employee relationship with drivers.

Uber's strategy to avoid discrimination accusations thus far has been its claim that it is merely a technology company that matches independent contractors with potential customers. Thus, Uber claims that as a technology company it is not bound to abide by the same laws that are intended to regulate other providers of transportation services (Wieczer, 2015).

California Labor Commission rules Uber drivers are employees, June, 2015. A major event in the early life of DRS services occurred on June 16, 2015 when a ruling by a judge for the California Labor Commission said that an Uber driver should be classified as an employee of the company, and not as an independent contractor (Issac & Singer, 2015). The implications of this decision will possibly determine the future direction of the sharing economy.

DRS is a significant part of the so-called sharing economy. The sharing economy is a system of collaborative consumption where parties share services in real time using enabling technologies such as the Internet and mobile communication devices with global positioning system (GPS) technology making them location aware (Botsman & Rogers, 2010). The business model for the sharing economy relies on technology companies with low overhead that can match parties who are either seeking to sell or seeking to receive, services. Thus, technology companies could be looked at as "platforms" facilitating transactions with limited or no need for a large physical plant or large staff of employees. Some parts of the sharing economy require traditional elements. For example, for-profit companies like Zipcar, a division of Avis Rentals, relies on enabling technologies such as smartphones and the Internet to allow customers to book cars (Figure 4.2). However, Zipcar requires an inventory of vehicles and a physical place to park them. Employees are needed to attend to both the inventory and physical facility that stores the vehicles while not in use (Sundararajan, 2013). DRS services such as Uber, Lyft, and SideCar, have thus far remained free of the constraints of inventory and physical plant because they rely on independent contractors who provide their private vehicles.

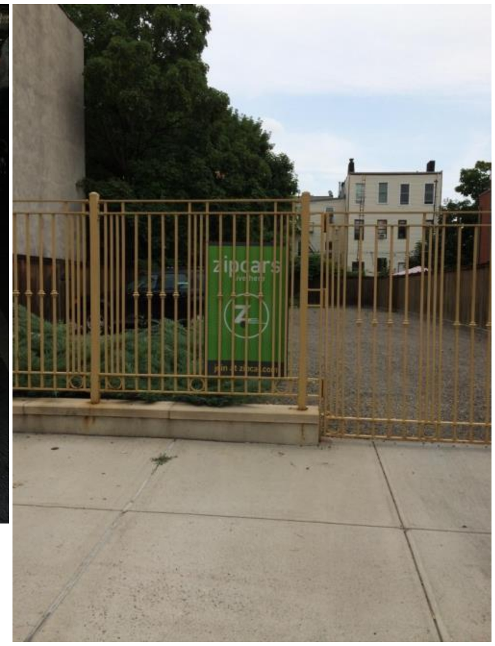

Figure 4.2: Unlike DRS services such as Uber and Lyft, car sharing companies maintain and fleet and a facility to store vehicles (Source: John DiGianni)

The California Labor Commission decision in San Francisco, however, could have major consequences for DRS services who relied on drivers offering their services as independent contractors. Uber contends that the ruling's scope was limited to the person who files the case (Moore, 2015). If the ruling sets a broad precedent, DRS services would have to pay benefits to employees such as health care and payroll taxes. A sharing economy under this scenario would not differ greatly from the employer/employee economy of the past century.

4.3 New York

4.3.1 Introduction

New York was chosen for comparison due to its long history of livery vehicles and the regulation of that industry. Early for-hire electric vehicles began arriving on the streets of New York by the end of the nineteenth century. As with today's technology that has become associated with DRS, early automobiles were the cutting-edge technology of that time in history. They were often too expensive for the average individual to purchase. Hence, early taxicab companies were often fleets owned by entrepreneurs who knew where to locate the best vehicles, and how to secure the financing to purchase them, much like today's start-ups from the Silicon Valley.

In 1907, New York businessman Harry N. Allen was inspired to create one of the city's earliest fleets. Allen was reacting to the high prices charged by independent drivers in what he called "vehicular extortion" (Hodges, 2007). The solution, according to Allen, was to start a company that would offer superior service compared with the status quo of the day. A clean and modern fleet would appeal to passengers and become a popular alternative. He purchases a fleet of sixty-five French manufacturer Darracq cabs that were equipped with fare meters. Drivers wore matching uniforms. Allen's experiment created a valuable service with a corporate identity. Ultimately, his New York Taxicab Company was successful and prospered. Hence, taxicabs became the new standard for transportation in the City of New York (Hodges, 2007).

The historical context was provided to illustrate parallels with the development of DRS today in San Francisco. Disruptive innovation in the transportation industry had taken place more than one hundred years ago in New York. As the city entered the period after World War I, its social atmosphere intensified as events such as the Jazz Age and Prohibition collided (Hodges, 2007). In 1904, the city's new subway opened, three years before Harry N. Allen's New York Taxicab Company. What was good for working people, however, would not suffice for the nightlife of Manhattan. New York's social nightlife in the 1920s saw the taxicab become a standard mode of urban transportation. During this time, fleets were organized to the degree that they had an industry-dedicated magazine. Cab News was an example of a magazine published by the fleet owners that was used to promote their companies. The magazine was also used to mold an image of the industry favorable to the fleet owners. News articles would paint an unflattering picture of independent taxicab owner-operators as coarse individuals unworthy of patronage (Hodges, 2007). This tactic is similar to the one used presently by Uber and Lyft today who portray their drivers as clean-cut citizens owning well maintained late model vehicle.

4.3.2 Background

In New York, privately owned fleets lease yellow taxi medallion vehicles to drivers. A medallion is a small metal plate with information inscribed such as a serial number, attached to the vehicle's hood. Medallions are sold by the city's Taxi and Limousine Commission, a municipal regulatory body that has jurisdiction over all the FHVs. The medallion allows the vehicles to be regulated and used as a for-hire livery conveyance. Medallions were created in New York in 1937 under the Haas Act, signed into law by then-Mayor Fiorello H. La Guardia. The Act was partially in response to a condition caused by the Great Depression when thousands of unregulated vehicles filled Manhattan streets with men trying to earn a living.

Traditional taxis and limousines are temporarily leased to drivers who use the vehicle for a specified shift, after which the vehicle is leased again at the end of his or her work shift to the next driver who repeats the process. Thus, it is often the case that a New York medallion cab is driven continuously for several or more 24-hour periods. The average yellow New York medallion cab is driven 180 miles per shift. The New York yellow taxi fleet can provide approximately 485,000 trips per day, most with an average trip distance of 2.6 miles. Yellow taxi activity is primarily in Manhattan and accounts for 90.3% of all pick-ups (Table 4.2) (New York City Taxi and Limousine Commission, 2014).

Table 4.2: Yellow taxi activity in New York, 2014.

Borough	**Percent of all Taxi Pick-ups**
Manhattan	90.3%
Bronx	0.9%
Brooklyn	3.1%
Queens	1.5%
Staten Island	0.8%
All Airports (JFK and LGA)	3.5%
New York City	100.0%
Source: New York Taxi and Limousine Commission, 2014 Taxicab Fact Book (2014)	

On the other hand, DRS drivers are owner-operators. Hence, their vehicles sit idle when not in use. From a monetary perspective there is more efficient use of the traditional taxicab, however, from an environmental view, the vehicle's gasoline or diesel engine continuously operates, thus contributing to anthropogenically induced atmospheric GHGs. The operation of DRS vehicles is sometimes optimized by owners who will "share" the use of the vehicle with other drivers during hours when their non-working hours.

Uber and other apps have allegedly filled a need, especially in areas where taxi service was difficult to summon, mainly due to the nature of how they are regulated. "Most" jurisdictions issue the medallions and place limits on how many there can per year. Thus, if a city sets a medallion limit of 1,500, then only 1,500 taxis can operate. Uber can dispatch as many cars as the system can handle at any one time. As of March 2015, there were more Uber vehicles operating in New York than yellow medallion taxicabs. According the current TLC Commission Meera Joshi, there were 14,088 Uber vehicles operating compared to 13,587taxis. (Pramuk, 2015). The following section is a chronology of legal events, many regulatory that occurred in New York with the arrival of DRS.

4.3.3 Chronology

Two taxi medallions fetch a price of $1 million each, October, 2011. Prior to the arrival of Uber in New York, two taxi medallions sold for $1 million each. The price was highest recorded sale in the city's history since the medallion system began in 1937. Back then, the historical cost of a medallion was $10 (Grynbaum, 2011). This story is significant because it occurs in the same month and year Uber was launched in New York. DRS services such as Uber have made a direct impact on the medallion according to research produced at HVM Capital, LLC, a hedge fund that publishes research on the taxicab medallion industry (Badger, 2014). Medallion prices in many U.S. have fallen as

DRS services continue to make inroads and replace traditional taxicabs (Hickman, 2015). In Chicago, for example, medallion prices have dropped from a high of $375,000 in April 2014 to $150,000 by December 2014. Although the price fluctuation of medallions is not a legal event, some medallions owners have sought to sue municipalities for value lost in their medallions based on the takings clause of the Fifth Amendment of the United States Constitution (PR Newswire, 2015).

New York City Taxi and Limousine Commission (TLC) does not authorize the use of smartphones for cab-hailing apps, September, 2012. David S. Yassky, chairman of the TLC, issues a statement saying that smartphone apps will not be allowed until contracts with payment

UberTaxi pulls out of New York due to legal questions about whether its app violated TLC guidelines, October, 2012. While passenger demand for the smartphone app was high according to Uber's chief executive Travis Kalanick, drivers dropped out of the program due to fears of reprisal from the TLC (Flegenheimer, 2012b). Mr. Kalanick wrote on his blog that the TLC had tried to "squash the effort" (Kalanick, 2012).

New York Department of Financial Services orders SideCar and RelayRides to cease and desist, May, 2013. Shortly after SideCar, the smallest of the major DRSs, was launched in New York in March 2013, the New York Department of Financial Services ordered that they and RelayRides, a peer-to-peer car-sharing[3] service, cease and desist. In

[3] The concept of short-term car rentals begins in 1948 in Switzerland where car ownership was prohibitive during the post-war recovery period. Early programs in Europe starting in 1971 in France with "Procotip"; "Witkar" in Netherlands, 1973; "Green Cars" in U.K. late 1970s'; and "Vivalla Bil" in Sweden, 1983.

the case of RelayRides, its chief executive officer, Ander Haddad, commented on his blog that the company was suspending all service in the state because the New York Department of Financial Services alleged that the company was not complying with unique aspects of New York insurance law (Chernova, 2013). The New York Department of Financial Services is the state's regulatory agency that supervises all insurance companies that do business in the state.

TLC deputy commissioner joins Uber, May, 2014. An indication of where DRS is going can be seen in the TLC deputy commissioner's departure and new employment by Uber Technologies.

In the United States, Purdue University conducted research on car sharing from 1983 to 1986. The Short Term Auto Rental (STAR) was established in San Francisco by a private company and ran from 1983 to 1985.

A common thread among these early programs is their quick failure rate usually attributed to poor planning. Of the previously mentioned programs, only STAR based in San Francisco had positive results from the consumer's perspective (Transportation Cooperative Research Program, 2005).

Car sharing in its current iteration has roots in Switzerland and Germany with programs dating to the late 1980s. Mobility Switzerland in 1987 is the first sizeable car sharing company based on the present model. Mobility Switzerland is still a leading car share program in Europe. Statt Auto Berlin followed one year later in 1988. Shortly afterward car sharing programs began to proliferate throughout Europe. By 2004, there were 70,000 cars sharing members in Germany and 60,000 in Switzerland (Transportation Cooperative Research Program, 2005).

By 1994, the concept of car sharing arrived in North America n Quebec City with Auto-Com, which later became Communauto. In the United States, the first large-scale program, CarSharing Portland, grew rapidly from its beginning in 1998. As of 2008 there were 14 active car sharing programs in Canada and 19 in the United States. By 2009, there were approximately 319,000 cars sharing members with 7,500 vehicles available to them in North America. The four largest providers serve 99% and 95.2% of the membership, respectively in the United States and Canada (Shaheen, et al., 2009).

Lyft plans launch in Brooklyn and Queens and is halted by TLC, July, 2014. DRS service Lyft planned to enter New York via the outer boroughs of Brooklyn and Queens. It's launch date was set for Friday, July 11th. Days before the launch, the TLC sent out a notice warning drivers that Lyft was not yet approved by the commission. The commission's primary concern was city-licensed drivers working for Lyft as an alternative (Huet, 2014). For taxicab drivers, the move between DRS services and traditional taxis is often fluid. Many do not see one service as "better" or "worse" than the other, but "different" in how the service can fulfill his or her needs at the moment.

Lyft reaches a complex deal with TLC to launch service in New York, July, 2015. Two weeks after its anticipated launch in Brooklyn and Queens, Lyft received permission from the TLC to launch in all five boroughs of the city. The stipulation, however, was that all drivers had to be city-licensed by the TLC This varies from the Lyft business model that depended on private individuals who could enter and leave the Lyft platform without any regulatory requirements. Hence, New York City differs from the San Francisco model where the state CPUC created a separate class for app-based transportation, the TNC (Lawler, 2014). As of July, 2015, the TLC licensing requirement along with a require that the vehicle have TLC license plates is still in effect (Lyft, 2015).

A Crash victim filed a lawsuit against driver and Uber, March, 2015. Erin Sauchelli, a pedestrian seriously injured while in a crosswalk in Manhattan, filed a lawsuit against Uber and the driver of the vehicle. Sauchelli's claim is that the Uber driver was distracted by his app, a violation of New York State law. Sauchelli was walking in the crosswalk with her boyfriend, Wesley Manning, who died at the scene. Unlike the wrongful death lawsuit of Sofia Liu in San Francisco, the driver was temporarily suspended and then reinstated by Uber. The driver's TLC license was also suspended and reinstated (Aaron, 2015).

TLC proposes rules that would strengthen regulation of car-hailing apps like Uber and Lyft, May, 2015. The TLC proposed new rules aimed at DRS services. The regulatory agency's rules package included apps that will lock while vehicles are in motion, requiring estimates of fares during surge pricing[4].

4.4 Compare and Contrast

The following section compares and contrasts the chronologies of the legal and administrative events that were recorded for San Francisco and New York. The similarities and differences are presented to shed light on how DRS has evolved in two of its most critical markets.

DRS status. The study reveals the difference in the status of DRS services in both cities. Although the companies are the same, the rules they must navigate are different and depend largely on the regulatory body whose jurisdiction they fall under. In the case of San Francisco, DRS services benefit from their status as TNCs, a category created by the CPUC, the state regulatory body with jurisdiction over passenger transportation companies (California Public Utilities Commission, 2013b). A difference can also be

[4] Surge Pricing is when rates increase based on demand. On their website, Uber explains the increase is to ensure that there are enough drivers on the road during peak periods (e.g. sporting events, weather related, holidays, etc.). Lyft has a similar policy called Prime Time. Both companies have faced criticism for this policy, yet they defends using Surge Pricing and Prime Time stating that it puts more cars on the road during the busiest periods (Davidson, 2015).

noted in that the CPUC initially explored whether DRS services fell under its scope of influence, unlike the New York TLC. TNC status preserves the intended nature of DRS, which is ride sharing accessible to drivers who want to be matched with riders without the need for livery licensing. However, in June, 2015, a judge for the California Labor Commission ruled in favor of a driver in a case where Uber is required to compensate her as an employee rather than an independent contractor (Huet, 2015). This ruling has ramifications not only for California DRS drivers but may also be seen as a precedent that other state labor commissions will follow. Many states have used the CPUC category of TNC as a precedent to follow. Indents should just be ½ inch

In New York, DRS services are influenced by the TLC. The regulatory body has jurisdiction over all FHVs that operate in the city. Early on, the TLC was successful in requiring Uber to follow city-licensing rules. Thus, companies like Uber, and more recently Lyft, must access a pool of licensed TLC drivers. The drivers vehicles must also carry TLC License plates (Lawler, 2014). This policy is unlike DRS services in San Francisco where DRS drivers do not have to be licensed livery drivers.

Wrongful Death. Sofia Liu's death calls into question the structure of the insurance rules created by the CPUC (Table 4.1). Uber has managed thus far to fight the rules established in September, 2013 by the CPUC (California Public Utilities Commission, 2013c). The San Francisco case differs from the New York case in that although the driver admits to using the Uber app at the time of the accident, Uber has been successful in its argument that the driver was not performing Uber business, but using the GPS function of the app. Also, Uber contends in the San Francisco case that the driver is not an employee, but an Uber software licensee. Uber also contends that the driver was not carrying a passenger, or on his way to pick up a fare at the time of the crash (Williams, 2014).In NYC, the plaintiff is using the state's law against distracted driving, and also the TLC's rule against using an electronic device while driving (Aaron, 2015).

Medallions. In San Francisco, medallions remain stable as the SFMTA sets the price (Said, 2015). In New York, the medallion are treated as an investment instrument and are tied to financial markets that set the price based on demand. Medallion transactions are often handled by financial companies, such as Medallion Financial, a lender who handles medallion sales (Grynbaum, 2011).

Cease and Desist orders. In San Francisco, the large DRS service are often positioned well to legally challenge cease and desist order. In New York, cease and desist orders are effective for smaller companies that lack resources to mount a legal battle, such as in the cases involving SideCar and RelayRides (Chernova, 2013). The process for large companies in New York, such as Uber and Lyft, is different. In the case of New York, the regulatory body, the TLC, exercises much control directly over the licensed drivers. It is common, therefore, as in the case of the Lyft launch in 2014, for the TLC to issue warnings to drivers that discourage them from working for the DRS service. The warnings can be interpreted as threats to losing one's license. Since DRS services must choose a city-licensed driver, the pool of available drivers becomes too small. Hence, the

DRS is forced to exit the market or capitulate to the demands of the TLC if they want to conduct business in New York (Lawler, 2014).

4.5 Conclusion

Comparing and contrasting the city case histories chronologically was insightful to instruct how DRS is evolving in two of the more influential markets in the nation. In San Francisco, were modern ICT-enabled DRS began, there were ten events chronologically recorded from 2010 to 2015. In New York, where regulation of the traditional taxi industry began in 1937 with the Haas Act, there were nine events recorded.

In summary, events in San Francisco have moved quickly beginning with early establishment of the major companies, i.e. Uber and Lyft, and early regulation and defining of the DRS business model with the CPUC ruling on TNCs in 2013. The CPUC ruling has also moved quickly to establish insurance rules for DRS services that have been emulated in other U.S. cities. DRS in San Francisco has appeared to catch opposing stakeholders off-guard and is on track laying the groundwork for this new transportation service that is being launched in other states and municipalities.

Challenges such as the wrongful death of a pedestrian in the January 2014 lawsuit pose more of a minor financial threat than one that is existential. With a valuation of approximately $50 billion as of May, 2015, Uber is poised to be the world's most valuable private start-up company, exceeding older established transportation companies such as FedEx, last valued at $45 billion, and at Nissan Motor, with a capitalization of $47 billion (Tam & de la Merced, 2015)

TNCs have encountered an obstruction in San Francisco, however, with the recent ruling by a California Labor Commission judge (Issac & Singer, 2015). The ruling states that Uber's drivers are not independent contractors, but instead are employees of the company based on how the company oversees the screening of drivers and setting of prices for rides. Uber contends that the decision only applies to the single individual name in the lawsuit (Wood, 2015). The legal chronology of this review ends with this latest major event and is significant since the outcome will dictate whether the DRS model will be encumbered with employees, a facet of earlier ridesharing models that required elements of traditional businesses such as Zipcar (Sundararajan, 2013).

In New York, penetration of the urban transportation market has moved quickly despite regulation by the city's TLC. The regulatory agency was quick to claim jurisdiction over DRS services and used modifications to existing rules to incorporate city-licensed drivers into the disruption of the medallion-based taxicab industry. The New York yellow taxi medallion hit a historic high of $1.3 million in April 2013 and has dropped in value to approximately $840,000 as of March 2015 (Caruthers, 2015).

Hence, in New York, DRS has adapted to the existing regulatory environment at the expense of the medallion. system. In the case of New York, more research will be required to determine the ramifications of a collapse of the medallion system and which parties stand to benefit from such change.

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Chapter 5

Conclusions and recommendations

5. Introduction

The research set out to explore the current state and directions of dynamic ridesharing (DRS), specifically within the United States. DRS can be traced back to the early car sharing clubs of World War II, and ultimately to present-day Internet-enabled and location-aware DRS. Earlier iterations of ridesharing were usually an employer or government sponsored endeavors. The organizational involvement of employers and government agencies were necessary to initiate matches between drivers and riders. As ridesharing progressed, telecommunications were used in conjunction with early Internet technology to deliver reliable matching of drivers and riders (Saddiqi & Buliung, 2013). With the wide public acceptance of smartphones and social media websites such as Facebook and Twitter, ridesharing had the final components necessary to allow real-time matching (Amey, Attanucci, & Mishalani, 2011).

Chapter 2 gave the history of DRS as it relates to its previous iterations, i.e. carpools, and ridesharing. The review states what is new about DRS, which is mainly, its departure from the traditional disciplines of transportation engineering and planning. Both disciplines have had primary roles in applying Transportation Demand Management strategies to reduce single-occupant vehicle use by shifting drivers to high-occupancy modes such as carpooling and mass transit (Black & Schreffler, 2010).

The research revealed what is happening in a selection of cities where this emerging innovation is being allowed to play itself out. For example, in San Francisco, the origination point of DRS, regulators were comparatively quick to set mandatory rules regarding how driver records, criminal background checks, vehicle safety inspections, and insurance issues were to be addressed. The California Public Utilities Commission (CPUC) became the state agency with jurisdiction over the newly created Transportation Network Companies (TNCs), the name used to describe DRS platforms that used smartphones and Internet technology to match riders with drivers (California Public Utilities Commission, 2013). In New York, the birthplace of the medallion system,, there are now more Uber vehicles than yellow taxis according to the city's Taxi and Limousine Commission, the municipal agency charged with jurisdiction over all for-hire-vehicles (FHVs) (Pramuk, 2015). A Chapter 4 review of these two premier cities revealed that establishment of the major DRS platforms, Uber, Lyft, and SideCar, has been fraught with legal issues that threaten their continued operation. Examination of the two cities also revealed who is involved in this new form of urban transportation. Aside from the primary stakeholders, i.e. the DRS platforms' management, regulatory agencies, and taxi and limousine labor groups, a large part of the driving force has been broad consumer acceptance of the enabling technologies that make real-time ridesharing possible.

Chapter 3 examined who are the users of DRS. A summary of the national survey of 306 respondents shows striking homogeneity among the users who were riders. They are predominately White, college educated, and from households with high incomes.

Recommendations based on these findings indicate further research needed to determine the implications that this elite group has on the future direction of urban transportation.

5.1 Limitations of the study

The study opens the view of the challenge of urban transportation that is continuous. Urban transportation has been evolving in the American city through much of the Industrial Age. As cities grow, the challenge becomes more complex. An indication of the complexity is the study's singular focus on transportation. It does not address other urban systems such as water, energy, and waste disposal.

Based on the research presented, change is coming to transportation, yet no one can yet predict how to manage the change. For example, in the case of Uber, Lyft, and SideCar drivers are independent contractors who set their work hours based on personal preference. The status of the independent contractor is fraught with legal ramifications that are presently being played out in the U.S. courts (Wood, 2015). As cities grow and become centers of activity without restriction to time-of-day, the independent contractor nature of DRS will present challenges to populations that will require transportation during non-peak hours. Already, monetary restrictions on the operation of public transportation systems reduce access during a period of low ridership.

Limitations of the study also do not answer why DRS is spreading rapidly from one city to the next and displacing traditional urban fixtures such as taxicabs. The study offered only what is happening in cities and who is involved.

5.2 Recommendations

This DRS study was an introduction to a technology that is used by a cross-section of the urban population that uses a public service that is privately financed. In its present state, the technology is used by individuals who have the financial means to pay for the service. This has been confirmed by the survey in Chapter 3 of the study. The survey points to a national sample of individuals who can use DRS. The use of DRS by this elite group is based on their self-interest. Their elite status is defined primarily by the survey's responses that show users who are highly educated, i.e. graduate school level, and earning incomes above $200,000 per household. This self-interest by this group is in direct conflict with the larger public who do not have the means to use DRS because they are handicapped by lower incomes.

Lower income groups, however, are not totally removed from participation in the new technology. They are often the drivers of vehicles who are earning income through registration with DRS platforms. Participation by lower income users may be short-lived as further advancements in technology continue and contribute to the convergence of the automobile and information technology industries.

Like elevator operators of the past century, FHV drivers may become anachronistic with continued advancements in driverless technology. Presently, Uber is partnering with Google and Carnegie Mellon University to work on mapping technology, safety, and autonomous vehicles. A partnership of Uber and Carnegie Mellon University call the Advanced Technologies Center was announced in February 2015 (Uber, 2015).

The partnership, based in Pittsburgh, will focus primarily on the development of an Uber vehicle that will pickup and drop off passengers autonomously. The ramifications of driverless vehicle technology are enormous and will impact not only transportation but labor, as well as more human-based employment, is lost to the roboticization of the economy (Winker & Macmillan, 2015).

Recommendation for future research is also made based on the pilot study of Chapter 4 that looked at the two premier cities, San Francisco and New York. The pilot study used legal and administrative reports to examine how DRS works in two large cities. Further research is needed to investigate how the DRS process repeats itself in cities of 100,000 with an exponential increase to 1 million. The research would be based on Raymond Murphy's study of the American central business district that was an urban geography study that attempted to delimit the physical boundaries of the city's downtown (Murphy, 1973). By delimitation of the boundaries within which DRS is successful it is hoped that a metric could be developed for determining where to use the service. The metric determining boundary delimitations could have application in establishing whether DRS works everywhere, and especially if it works in smaller cities.

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APPENDIX A

DRS User Survey

Dynamic Ridesharing

* Required

1. **Have you in the past 60 days used dynamic ridesharing?** *
Mark only one oval.
- Yes
- No *After the last question in this section, stop filling out this form.*

2. **Gender** *
Mark only one oval.
- Both
- Male
- Female

3. **Age** *
Mark only one oval.
- 18-20
- 21-30
- 31-40
- 41-50
- 51-60
- 61-70
- 71-80
- 80+

4. **Education** *
Mark only one oval.
- Primary school
- Some high school
- High school
- Some college
- 2-year college
- 4-year college
- Graduate degree

5. **Zip code of your primary residence** *

6. **Race/Ethnicity** *
Mark only one oval.

- White
- Black / African American
- American Indian or Alaska Native
- Asian
- Pacific Islander
- Latino- White
- Latino- Non-white
- Mixed-race

7. **Living Arrangements** *
Mark only one oval.

- Rent
- Own
- Other

8. **Marital Status** *
Mark only one oval.

- Married
- Widowed
- Divorced
- Separated
- In a domestic partnership or civil union
- Single, but cohabiting with a significant other
- Never married

9. **Number of available vehicles in household** *
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5+

10. **Employment Status** *

Mark only one oval.

- ◯ Employed part-time
- ◯ Employed full-time
- ◯ Not employed, looking for work
- ◯ Not employed, Not looking for work
- ◯ Retired
- ◯ Disabled, not able to work

11. **Student Status** *

Mark only one oval.

- ◯ Full time in graduate school
- ◯ Part time in graduate school
- ◯ Full time at a four year college
- ◯ Part time at a four year college
- ◯ Full time at a two year college
- ◯ Vocational or trade school
- ◯ High school or equivalent
- ◯ Not currently enrolled as a student

12. **Industry** *

Mark only one oval.

- ( ) Advertising & Marketing
- ( ) Agriculture
- ( ) Airlines & Aerospace (including defense)
- ( ) Automotive
- ( ) Business Support & Logistics
- ( ) Construction, Machinery, and Homes
- ( ) Education
- ( ) Entertainment & Leisure
- ( ) Food & Beverages
- ( ) Government
- ( ) Health Care Health Care & Pharmaceuticals
- ( ) Insurance
- ( ) Manufacturing
- ( ) Nonprofit
- ( ) Retail & Consumer Durables
- ( ) Real Estate
- ( ) Telecommunications, Technology, Internet & Electronics
- ( ) Utilities, Energy, and Extraction

13. **Which of the Dynamic Ridesharing applications on your smartphone have you used? Please check all that apply.** *

Check all that apply.

- [ ] Uber / UberX
- [ ] Lyft
- [ ] SideCar
- [ ] Hitch-a-Ride
- [ ] Car.ma
- [ ] Summon
- [ ] Wingz
- [ ] Other: ____________________

14. **How long have you been using dynamic ridesharing?** *

Mark only one oval.

- Less than 1 month
- 1-3 months
- 4-6 months
- 6 months to 1 year
- More than one year

15. **What is your annual household income?** *

Mark only one oval.

- Less than $10,000
- $10,0000 - $19,999
- $20,000 - $29,999
- $30,000 - $39,999
- $40,000 - $49,999
- $50,000 - $59,9999
- $60,000 - $69,999
- $70,000 - $79,999
- $80,000- $89,999
- $90,000 - $99,999
- $100,000- $149,999
- More than $150,000

16. **People use dynamic ridesharing to access various services and amenities. Please tell us where you have traveled to using a dynamic ridesharing service?** *

Check all that apply.

- Work
- School
- Food shopping
- Bank
- Religious
- Personal care (hair, gym, nails, etc.)
- Medical
- Dinning out
- Visiting friends and family
- Cultural events, e.g. concerts, movies
- Parks/outdoors
- Other: ____________

17. **Which mode of transportation are you most often replacing when you use dynamic ridesharing?** *

Mark only one oval.

- Car
- Bus
- Trolley, tram, streetcar
- Subway or elevated
- Railroad
- Ferryboat
- Taxi
- Bicycle
- Walking
- Other: ____________

18. **When using dynamic ridesharing as a passenger, do you connect to other transport modes such as buses, streetcars, or subways in order to complete your trip?** *

Answer "Not applicable" if you use DRS primarily as a driver.
Mark only one oval.

- Never
- Sometimes
- Always
- Not applicable
- Other: ____________

19. **When using dynamic ridesharing as a passenger, on average how many people, including yourself, were passengers in the vehicle?** *

Enter "1" if on average you travel alone. Enter "Not applicable" if on average you are mostly a driver.
Mark only one oval.

- 1
- 2
- 3 or more
- Not applicable

20. **If you are primarily a driver, on average what is your total monthly cost for gasoline, auto insurance, car payment (if applicable), maintenance, tolls, and parking.** *

Mark only one oval.

- Less than $100
- $100 - $199
- $200 - $299
- $300 - $399
- $400 - $499
- More than $500
- Not applicable

21. **I am less concerned about safety and security knowing the driver has had a criminal background check and is covered with sufficient liability insurance in the event of an accident.** *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree						Strongly agree

22. **The driver and rider rating system used by many dynamic ridesharing services helps me to make an informed decision.** *

Mark only one oval.

	1	2	3	4	5	
Strogly disagree						Strongly agree

23. **I use dynamic ridesharing because I am willing to give up some of the flexibility of driving alone in exhange for other advantages, such as conserving gasoline, saving time, and saving money.** *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree						Strongly agree

24. *

I would use dynamic ridesharing very often if I was assured of getting a return trip.

Mark only one oval.

	1	2	3	4	5	
Strongly disagree						Stringly agree

25. **To what extent is not owning a car a significant factor in choosing dynamic ridesharing?** *
Mark only one oval.

	1	2	3	4	5	
Not a factor	◯	◯	◯	◯	◯	Very important

26. **To what extent is reducing impacts on the physical environment significant factors in choosing dynamic ridesharing?** *
Mark only one oval.

	1	2	3	4	5	
Not a factor	◯	◯	◯	◯	◯	Very important

27. **To what extent is meeting new people and having a sense of community significant factors in choosing dynamic ridesharing?** *
Mark only one oval.

	1	2	3	4	5	
Not a factor	◯	◯	◯	◯	◯	Very important

28. **To what extent is using dynamic ridesharing a better option than using a regular taxi or hired limo?** *
Mark only one oval.

	1	2	3	4	5	
Not a factor	◯	◯	◯	◯	◯	Very important

29. **To what extent is using dynamic ridesharing a better option than using public transportation?** *
Mark only one oval.

	1	2	3	4	5	
Not significant	◯	◯	◯	◯	◯	Very significant

30. **Would you consider moving to a larger home in an area with limited or no public transportation if dynamic ridesharing was a reliable option?** *
Mark only one oval.

	1	2	3	4	5	
Not considering	◯	◯	◯	◯	◯	Highly considering

APPENDIX B

Raw Data From DRS Survey

Dynamic Ridesharing

1. Do you wish to continue?		
Answer Options	**Response Percent**	**Response Count**
Yes	91.6%	448
No	8.4%	41
	answered question	**489**
	skipped question	**334**

2. Do you agree to participate in this study?		
Answer Options	**Response Percent**	**Response Count**
I agree	80.7%	592
I decline	19.3%	142
	answered question	**734**
	skipped question	**89**

3. Have you in the past 30 days used dynamic ridesharing (Uber, Lyft, etc.)?		
Answer Options	**Response Percent**	**Response Count**
Yes	55.0%	327
No	45.0%	268
	answered question	**595**
	skipped question	**228**

4. Which of the Dynamic Ridesharing applications on your smartphone have you used? Please check all that apply.		
Answer Options	**Response Percent**	**Response Count**
Uber Black	36.7%	119
Uber X	83.3%	270
Lyft	28.1%	91
SideCar	3.4%	11
Hitch-a-Ride	1.2%	4
Car.ma	1.2%	4
Summon	1.2%	4
Wingz	0.9%	3
Other (please specify)	2.8%	9
	answered question	**324**
	skipped question	**499**

5. How long have you been using dynamic ridesharing?		
Answer Options	**Response Percent**	**Response Count**
Less than 1 month	4.3%	14
1-3 months	14.9%	48
4-6 months	14.2%	46
6 months to 1 year	26.9%	87
More than 1 year	39.6%	128
	answered question	**323**
	skipped question	**500**

6. People use dynamic ridesharing to access various services and amenities. Please tell us where you have traveled to using a dynamic ridesharing service?		
Answer Options	**Response Percent**	**Response Count**
Work	38.5%	124
School	6.5%	21
Food shopping	9.9%	32
Bank	4.7%	15
Religious worship	2.2%	7
Personal care	12.1%	39
Medical	12.4%	40
Dinning out	65.2%	210
Visiting friends or family	42.2%	136
Parks/outdoor activities	10.9%	35
Other (please specify)	41.3%	133
	answered question	**322**
	skipped question	**501**

7. Which mode of transportation are you most often replacing when you use dynamic ridesharing?		
Answer Options	**Response Percent**	**Response Count**
Personal car	42.4%	136
Bus	9.7%	31
Trolley, tram, streetcar, or light rail	0.6%	2
Subway or elevated	7.8%	25
Railroad	0.6%	2
Ferryboat	0.0%	0
Taxi	30.2%	97
Bicycle	1.2%	4
Walking	4.7%	15
Other (please specify)	2.8%	9
	answered question	**321**
	skipped question	**502**

8. When using dynamic ridesharing as a passenger, do you connect to other transport modes such as buses, streetcars, or subways in order to complete your trip?		
Answer Options	**Response Percent**	**Response Count**
Never	58.3%	186
Sometimes	39.5%	126
Always	0.9%	3
Not applicable if you use dynamic ridesharing primarily	1.3%	4
	answered question	**319**
	skipped question	**504**

9. When using dynamic ridesharing as a passenger, on average how many people, including yourself, were passengers in the vehicle?		
Answer Options	**Response Percent**	**Response Count**
1	34.2%	109
2	47.0%	150
3 or more	16.9%	54
Not applicable if you use dynamic ridesharing primarily	1.9%	6
	answered question	**319**
	skipped question	**504**

10. If you are primarily a driver, on average what is your total monthly cost for gasoline, auto insurance, car payment (if applicable), maintenance, tolls, and parking.		
Answer Options	**Response Percent**	**Response Count**
Less than $100	4.1%	13
$100-$199	13.5%	43
$200-$399	12.9%	41
$400-$499	5.0%	16
More than $500	10.7%	34
Not applicable if you use dynamic ridesharing primarily	53.9%	172
	answered question	**319**
	skipped question	**504**

11. I am less concerned about safety and security knowing the driver has had a criminal background check and is covered with sufficient liability insurance in the event of an accident.							
Answer Options	Strongly agree		Moderately agree		Strongly disagree	Rating Average	Response Count
	117	80	67	34	20	2.25	318
						answered question	318
						skipped question	505

12. The driver and rider rating system used by many dynamic ridesharing services helps me to make an informed decision.							
Answer Options	Strongly agree		Moderately agree		Strongly disagree	Rating Average	Response Count
	74	75	104	49	16	2.55	318
						answered question	318
						skipped question	505

13. I use dynamic ridesharing because I am willing to give up some of the flexibility of driving alone in exhange for other advantages, such as conserving gasoline, saving time, and saving money.							
Answer Options	Strongly agree		Moderately agree		Strongly disagree	Rating Average	Response Count
	65	63	97	62	27	2.75	314
						answered question	314
						skipped question	509

14. I would use dynamic ridesharing very often if I was assured of getting a return trip.							
Answer Options	Strongly agree		Moderately agree		Strongly disagree	Rating Average	Response Count
	44	54	117	75	24	2.94	314
						answered question	314
						skipped question	509

15. To what extent is not owning a car a significant factor in choosing dynamic ridesharing?								
Answer Options	Significant		Moderately significant		Not significant	N/A	Rating Average	Response Count
	54	21	27	7	88	113	3.27	310
							answered question	310
							skipped question	513

16. To what extent is reducing impacts on the physical environment a significant factor in choosing dynamic ridesharing?							
Answer Options	Important		Moderately important		Not important	Rating Average	Response Count
	19	21	85	84	101	3.73	310
						answered question	310
						skipped question	513

17. To what extent is meeting new people and/or having a sense of community a significant factor in choosing dynamic ridesharing?							
Answer Options	Significant		Moderately significant		Not significant	Rating Average	Response Count
	2	10	37	51	209	4.47	309
						answered question	309
						skipped question	514

18. To what extent is using dynamic ridesharing a better option than using a regular taxi or hired limousine?							
Answer Options	Better		Moderately better		Not better	Rating Average	Response Count
	175	63	47	16	8	1.77	309
						answered question	309
						skipped question	514

19. To what extent is using dynamic ridesharing a better option than using public transportation?							
Answer Options	Better		Moderately better		Not better	Rating Average	Response Count
	144	74	63	19	8	1.94	308
						answered question	308
						skipped question	515

20. Would you consider moving to a larger home in an area with limited or no public transportation if dynamic ridesharing was a reliable option?							
Answer Options	Consider		Moderately consider		Not consider	Rating Average	Response Count
	48	27	88	46	99	3.39	308
						answered question	308
						skipped question	515

21. What is your gender?		
Answer Options	**Response Percent**	**Response Count**
Male	50.7%	155
Female	49.3%	151
Both	0.0%	0
	answered question	**306**
	skipped question	**517**

22. What is your age?		
Answer Options	**Response Percent**	**Response Count**
18 to 24	17.2%	53
25 to 34	30.2%	93
35 to 44	15.3%	47
45 to 54	17.9%	55
55 to 64	13.0%	40
65 or older	6.5%	20
	answered question	**308**
	skipped question	**515**

23. What is the highest level of education you have completed?		
Answer Options	**Response Percent**	**Response Count**
Did not attend school	0.3%	1
Primary school	0.0%	0
Some high school	0.0%	0
Graduated from high school	1.3%	4
Vocational or trade school	0.3%	1
1 year of college	4.9%	15
2 years of college	6.2%	19
3 years of college	5.5%	17
Graduated from college	41.2%	127
Some graduate school	10.1%	31
Completed graduate school	30.2%	93
	answered question	**308**
	skipped question	**515**

24. Zip code of your primary residence	
Answer Options	**Response Count**
	308
answered question	**308**
skipped question	**515**

25. Are you White, Black or African-American, American Indian or Alaskan Native, Asian, Native Hawaiian or other Pacific islander, or some other race?		
Answer Options	**Response Percent**	**Response Count**
White	88.0%	271
Black or African-American	1.0%	3
American Indian or Alaskan Native	0.0%	0
Asian	4.5%	14
Native Hawaiian or other Pacific Islander	0.0%	0
From multiple races	6.5%	20
Some other race (please specify)		5
	answered question	**308**
	skipped question	**515**

26. Do you rent or own the place where you live?		
Answer Options	**Response Percent**	**Response Count**
Rent	49.0%	151
Own	48.4%	149
Other (please specify)	2.6%	8
	answered question	**308**
	skipped question	**515**

27. Which of the following best describes your current relationship status?		
Answer Options	**Response Percent**	**Response Count**
Married	45.8%	141
Widowed	1.0%	3
Divorced	2.6%	8
Separated	0.6%	2
In a domestic partnership or civil union	1.6%	5
Single, but cohabiting with a significant other	14.6%	45
Single, never married	33.8%	104
	answered question	**308**
	skipped question	**515**

28. Number of available vehicles in your household		
Answer Options	**Response Percent**	**Response Count**
0	17.2%	53
1	29.2%	90
2	36.4%	112
3	10.7%	33
4	4.9%	15
5+	1.6%	5
	answered question	**308**
	skipped question	**515**

29. Which of the following categories best describes your employment status?		
Answer Options	**Response Percent**	**Response Count**
Employed, working full-time	74.4%	229
Employed, working part-time	7.8%	24
Not employed, looking for work	3.6%	11
Not employed, NOT looking for work	4.9%	15
Retired	8.1%	25
Disabled, not able to work	1.3%	4
	answered question	**308**
	skipped question	**515**

30. Are you currently enrolled as a student?		
Answer Options	**Response Percent**	**Response Count**
Yes, full time in graduate school	4.2%	13
Yes, part time in graduate school	3.9%	12
Yes, full time at a four year undergraduate	6.2%	19
Yes, part time at a four year undergraduate	0.6%	2
Yes, full time at a two year undergraduate	0.6%	2
Yes, part time at a two year undergraduate	0.3%	1
Yes, at a high school or equivalent	0.0%	0
No, I am not currently enrolled as a student	84.1%	259
	answered question	**308**
	skipped question	**515**

31. Which of the following best describes the principal industry of your employment?		
Answer Options	**Response Percent**	**Response Count**
Advertising & Marketing	4.6%	14
Agriculture	0.0%	0
Airlines & Aerospace (including Defense)	1.0%	3
Automotive	0.3%	1
Business Support & Logistics	3.3%	10
Construction, Machinery, and Homes	1.6%	5
Education	9.8%	30
Entertainment & Leisure	2.9%	9
Finance & Financial Services	7.2%	22
Food & Beverages	2.6%	8
Government	2.0%	6
Healthcare & Pharmaceuticals	9.1%	28
Insurance	1.6%	5
Manufacturing	3.3%	10
Nonprofit	7.8%	24
Retail & Consumer Durables	2.9%	9
Real Estate	2.0%	6
Telecommunications, Technology, Internet & Electronics	12.7%	39
Transportation & Delivery	1.6%	5
Utilities, Energy, and Extraction	1.0%	3
I am currently not employed	8.1%	25
Other (please specify)	14.7%	45
	answered question	**307**
	skipped question	**516**

32. What is your approximate average household income?		
Answer Options	**Response Percent**	**Response Count**
$0-$24,999	7.2%	22
$25,000-$49,999	11.4%	35
$50,000-$74,999	16.3%	50
$75,000-$99,999	10.1%	31
$100,000-$124,999	11.1%	34
$125,000-$149,999	7.2%	22
$150,000-$174,999	7.5%	23
$175,000-$199,999	5.2%	16
$200,000 and up	23.9%	73
	answered question	**306**
	skipped question	**517**

33. Age		
Answer Options	**Response Percent**	**Response Count**
<18	0.0%	0
18 - 29	32.5%	245
30 - 44	29.8%	225
45 - 59	25.6%	193
>60	12.2%	92
	answered question	**755**
	skipped question	**68**

34. What is your gender?		
Answer Options	**Response Percent**	**Response Count**
Female	45.8%	346
Male	54.2%	409
	answered question	**755**
	skipped question	**68**

35. How much total combined money did all members of your HOUSEHOLD earn last year?		
Answer Options	**Response Percent**	**Response Count**
$0 to $9,999	4.1%	31
$10,000 to $24,999	3.6%	27
$25,000 to $49,999	9.7%	73
$50,000 to $74,999	13.5%	102
$75,000 to $99,999	10.7%	81
$100,000 to $124,999	10.6%	80
$125,000 to $149,999	8.0%	60
$150,000 to $174,999	5.2%	39
$175,000 to $199,999	3.6%	27
$200,000 and up	17.6%	133
Prefer not to answer	13.4%	101
	answered question	**754**
	skipped question	**69**

36. US Region		
Answer Options	**Response Percent**	**Response Count**
New England	8.0%	60
Middle Atlantic	13.5%	101
East North Central	11.5%	86
West North Central	5.6%	42
South Atlantic	17.1%	128
East South Central	2.8%	21
West South Central	6.9%	52
Mountain	6.1%	46
Pacific	28.5%	214
	answered question	**750**
	skipped question	**73**

37. Device Types		
Answer Options	**Response Percent**	**Response Count**
iOS Phone / Tablet	22.0%	166
Android Phone / Tablet	8.2%	62
Other Phone / Tablet	0.0%	0
Windows Desktop / Laptop	47.3%	357
MacOS Desktop / Laptop	21.3%	161
Other	1.2%	9
	answered question	**755**
	skipped question	**68**

APPENDIX C

CPUC press realease announcing established rules for newly created TNCs.

California Public Utilities Commission
505 Van Ness Ave., San Francisco

FOR IMMEDIATE RELEASE | **PRESS RELEASE**

Media Contact: Terrie Prosper, 415.703.1366, news@cpuc.ca.gov | Docket #: R.12-12-011

CPUC ESTABLISHES RULES FOR TRANSPORTATION NETWORK COMPANIES

SAN FRANCISCO, Sept. 19, 2013 -- The California Public Utilities Commission (CPUC) today took action to ensure that public safety is not compromised by the operation of transportation services that use an online-enabled platform to connect passengers with drivers who use their personal, non-commercial vehicles.

The CPUC determined that companies such as Lyft, SideCar, and UberX are charter party passenger carriers subject to CPUC jurisdiction. The CPUC created the category of Transportation Network Company (TNC) to apply to companies that provide prearranged transportation services for compensation using an online-enabled application (app) or platform to connect passengers with drivers using their personal vehicles.

The CPUC established 28 rules and regulations for TNCs. The rules include the requirements that TNCs must:

- Obtain a license from the CPUC to operate in California;
- Require each driver to undergo a criminal background check;
- Establish a driver training program;
- Implement a zero-tolerance policy on drugs and alcohol;
- Hold a commercial liability insurance policy that is more stringent than the CPUC's current requirement for limousines, requiring a minimum of $1 million per-incident coverage for incidents involving TNC vehicles and drivers in transit to or during a TNC trip, regardless of whether personal insurance allows for coverage; and,
- Conduct a 19-point car inspection.

A second phase of this proceeding will review the CPUC's existing regulations over limousines and other charter party carriers to ensure that public safety rules are up to date and responsive to the needs of today's transportation market.

"The CPUC is at the forefront of leadership in crafting new safety based regulations for a rapidly emerging industry," said CPUC President Michael R. Peevey, the lead Commissioner for this proceeding. "The rules we created today allow Transportation Network Companies to compete with more traditional forms of transportation and for both drivers and consumers to have greater choice within the transportation industry."

"Our decision emphasizes safety as a primary objective, while fostering the development of this nascent industry," said Commissioner Mark J. Ferron. "We have specified our expectations for the attributes of insurance. Now the insurance market will determine the best approach to ensure that there is coverage for passengers, drivers, and third-parties at all times while these vehicles are operating on a commercial basis."

The proposal voted on is available at
http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M077/K112/77112285.PDF

For more information on the CPUC, please visit www.cpuc.ca.gov.

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