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Cooperative Mobility for
Competitive Megaregions

The Role of Transportation Networking Companies in Megaregion Mobility

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16. Abstract Transportation Network Companies (TNCs) like Uber and Lyft have become popular forms of transportation in recent years. Researchers have worked to understand the qualitative impacts of these services, such as effects on the taxi industry, spatial and temporal distribution in cities, and effects on public transit; however, few studies have examined user attitudes towards TNCs and differences between heavy and lighter users of these. Additionally, few studies attempted the segmentation of users. To fill these research gaps, we conducted a megaregional survey of TNC users in the Texas Triangle Megaregion. Results indicated that most users who are motivated by the convenience of service take TNCs a few times a week or less. Those who take TNCs more regularly do so mainly for commuting purposes. Result also pointed out that these more frequent users are wealthier and are better educated.		
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Executive Summary

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Dr. Junfeng Jiao led the project and designed the survey. Dr. Guerra and Dr. Pan assisted project design and survey. Mr. Bischak and Ms. Hyden analyzed the data and drafted the report. Mr. Chen assisted report drafting.

Chapter 1. Introduction

1.1 Overview and Objectives

This research stemmed from the desire to better understand the more qualitative aspects of Transportation Network Company (TNC) usage. The aim was to gain some insight into why people utilize TNCs, how they value TNCs, and how they judge TNCs in relation to similar options such as conventional taxis and public transport. To that end, we conducted a large-scale survey of TNC users in the Texas Triangle Megaregion (Figure 1). This report proceeds as follows. First, in Chapter 1, we situate this research in the broader context of transportation planning and megaregional planning more specifically. Next, in Chapter 2, we detail our methods and overall findings. Then Chapter 3 discusses the implications of findings for urban planning. Finally, in the appendix, we provide a copy of our survey and other supplemental information.

1.2 Background

Since their inception, roughly around 2008, Uber and Lyft have achieved significant market penetration. According to the Pew Research Center nationwide survey, slightly more than one-third (36 percent) of U.S adults have used a TNC service (Jiang, 2019); however, TNCs' increasing popularity has presented cities with numerous challenges ranging from regulatory issues to congestion issues (Flores & Rayle, 2017; Schaller, 2018).

Within this context, researchers and policymakers have sought to understand how these services are functioning, mostly in a quantitative sense (a detailed overview of the current literature is presented in Chapter 2), but few studies have addressed one of the more critical questions about TNCs, namely *why* people are choosing to use them over other forms of transportation.

Understanding why people prefer these types of services to other, potentially competing services, like conventional taxis or public transit is critical for urban planning and policy. If the value of these services and user perceptions of these services can be understood, planners and policy makers can better understand where existing transport services are failing to meet user needs.

1.3 Positioning This Research in a Megaregional Context

Understanding how user value and perceive TNC service is not just valuable for planning at the city level, it is also important for planning at the megaregional scale. Within megaregional

transportation planning, the Federal Highway Administration (FHWA) has identified key objectives for improving megaregional transport (Read, Morley, Ross, & Smith, 2017). Most of these objectives do not apply to TNCs either generally or within a megaregional context. However, several of these objectives may intersect either with TNC regulation or planning at the megaregional scale. These include:

- Facilitate interregional coordination between transit providers.
- Plan for high-speed passenger rail [TNCs would support high-speed rail as a first mile/last mile solution]
- Coordinate interregional on transportation systems management and operations.
- Coordinate interregional on travel demand management (TDM).

TNCs and issues they present to bear on one or more of the above issues. For the first two objectives, TNCs might potentially facilitate connections between transit providers, fill in gaps between different modes, and serve as a first mile/last mile solution. For the third objective, TNC regulatory issues might best be coordinated at the megaregional level. Finally, management of TNCs will become a crucial part of TDM in cities and megaregions. Therefore, this research seeks to apply its findings to these areas of megaregional planning.

Chapter 2. Transportation Network Companies to TNCs

2.1 Abstract

Transportation Network Companies (TNCs) have become popular in recent years because of their ease of use and relative cost-efficiency; however, these services are significantly under-researched from the perspective of what user value and how they perceive these services. Additionally, there has been little academic research on the differences between heavy users of these services and more regular users of these services. We surveyed 1000 users in the Texas Triangle (Austin, Dallas, Houston, and San Antonio) to help answer these questions. We found that most users of these services are using them intermittently, on weekends, and to travel for leisure purposes. Heavy users, however, are far more likely to use them to commute, to connect to public transport, and to use these services on weekdays. Heavy users also tended to be wealthier and better educated. This research is one of the first studies that reveal different TNC user groups and their usage differences. It also contributes to the literature of users' perceptions on TNCs.

2.2 Introduction

In recent years, Transportation Network Companies (TNCs) have disrupted long-stable urban transportation markets (Berger, Chen, & Frey, 2018; Cramer & Krueger, 2016; Hampshire, Simek, Fabusuyi, Di, & Chen, 2017). At the intersection of technological advancement, the ubiquity of internet access, and increasing urbanization, TNC usage has snowballed since the introductions around 2008. These services allow for the arrangement of rides between drivers, offering the use of their vehicles for fares set by third-party providers, and riders (National Association of Insurance Companies, 2019). Platforms such as Uber and Lyft allow users to track the location of their drivers, see the route to be taken, and pay online through a connected credit card. On their own, TNCs symbolize critical characteristics of modern society – integration of technology into daily tasks, the priority that automobiles have in urban life, and the prevalence of freelance work.

TNCs have presented cities with both significant challenges and tremendous opportunities. On the one hand, they are providing users a convenient and relatively cost-effective to move around urban areas, which is especially true for areas further from the Central Business District, where public transport and conventional taxis are least available, and on-demand ride services like

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TNCs are more competitive (Schwieterman, 2019). TNCs, however, have also been controversial and presented cities with numerous challenges. Critics charge that TNCs are causing more congestion, are primarily used by a young, privileged, urban elite, and represent a dystopian future for labor where all workers are contracted without traditional employment benefits (Mulholland, 2016; Schaller, 2018).

Despite the intense debate surrounding TNCs, limited studies have focused on these services. Part of this is because it is hard to obtain data on TNC activities due to the companies themselves being reluctant to share it. Much of the research on TNCs have relied on web scrapping or even first-hand usage of TNCs themselves to obtain data (SFCTA, 2017; Henao & Marshall, 2018). However, the relative newness of TNCs has also meant that much research has not been conducted. This further complicates things for cities, as reliable data and a solid understanding of all stakeholders in urban transportation are necessary to craft sound policy and regulation. By gaining a clearer understanding of what these services are offering users and how individuals use them, policymakers and planners can better regulate them to maximize their benefits while minimizing their negative externalities such as increased traffic or safety concerns. Additionally, one central aspect of understanding the growth of TNCs is the user perception of these services. They have proven quite popular, a trend that is interesting because conventional taxis offer a similar service to consumers.

This paper aims to fill the knowledge gaps around users' perceptions of TNCs. We use a survey-based approach to understand TNC users in the four largest MSAs in Texas: Dallas, Houston, San Antonio, and Austin. A survey-based approach to TNC research has been used in numerous ways, such as investigating the comparison between ridesharing and other forms of shared transit (Rayle et al., 2015). Others have surveyed to determine motivations for use, allowing for modeling the perceived usefulness of ridesharing apps and the role that consumer agency and choice play in the success of TNCs (Zhu, Fung So, & Hudson 2016). Few studies, however, have explicitly examined how users are valuing these services, especially compared to conventional taxis and public transport. This study makes an original contribution by explicitly looking at user values and habits with regards to TNCs in Texas.

Additionally, this study makes a further and significant contribution in that we use our survey data to assess how TNC usage varies among different types of users. There may be differences among different types of users. To examine these distinctions, we segment our findings

based on gender, income, age, and user frequency (heavy vs. 'regular' users), to better understand how different types of users are taking advantage of these services. This paper proceeds in the following manner. First, we present a literature review of research on TNCs, with a particular emphasis on perceptions of TNCs and other survey-based work on TNCs. Then we detail our methods, followed by a descriptive analysis of our results. We then present our analysis of our findings segmented by gender, income, usage status, and age. Lastly, we discuss the implications of our research concerning both policy and planning practice.

2.3 Literature Review

The majority of TNC research typically looked at their impacts on other transport modes (e.g. bus, taxi) and urban environments overall. For example, studies have extensively examined how TNCs are impacting existing taxi markets, how TNCs are affecting traffic, where TNC usage takes place etc. But this literature review focuses on the two issues of research most germane to this study namely how users perceive TNCs and TNCs compare to public transit and conventional taxis.

First, many researchers have examined TNCs in contrast to other shared transportation services such as public transit and taxis. When measuring how riders evaluate their choice to use TNCs, many studies have found that users view ridesharing apps as a more convenient way to navigate around cities compared to other options (Rayle et al 2015; Nie 2017). Pew Research Center has identified an overwhelmingly positive view among TNC users as well. Based on their gathered responses, TNCs offer a more convenient option for those who have limited mobility or trouble accessing public transit, as more cost-effective than taxis, and as overall stress-reducers in commutes (Smith 2016). Though this data reflects the opinions of people who already choose to use these services, and thus may be skewed more positive than average, it offers insight that reveals patterns in the factors that cause people to choose TNCs.

Compared to public transit, the greater perceived choice and convenience that these P2P options offer, are major factors that draws riders to use TNC services (Zhu, Fung So, & Hudson, 2016). In this way, there is a significant difference between TNC and public transit. Transit is managed top-down by an entity such as transit agencies and thus requires riders to conform to the structure of the transit whereas TNCs conform to the users' desires. Therefore, consumers view

TNCs as providing them more freedom of choice (Wolfson & Tavor, 2018). This element of choice and self-determination is arguably a strong motivation for consumers, and many have identified the greater agency that products within the sharing economy provide as a positive characteristic (Bellotti et al., 2015; Hamari, Sjöklint, & Ukkonen, 2015; Zhu et al., 2016).

In terms of how users value TNCs, studies utilizing a variety of methodologies, including demand data from TNCs and surveys, have yielded an understanding of typical user demographics which is directly tied to how much demand users have for TNCs (Gerte, Konduri, & Eluru 2018; Rayle et al 2015). More affluent populations that are likely to have access to smartphones and the internet have easier necessary access to TNC platforms, which likely influences the accessibility of these platforms. Users that are drawn to these services also tend to be younger, often more so than the average taxi or transit user in respective cities (Rayle et al, 2015). TNC users are also more educated, a finding that is replicated across studies (Gerte, Konduri, & Eluru 2018; Rayle et al 2015; Smith 2016). Many riders surveyed by Rayle et al (2015) reported having personal vehicles at home, and thus their decision to utilize a TNC was often not motivated by necessity or dependence.

2.4 Methods

Based on the above literature review we concluded that research into users' perception about TNCs is sparse and no studies have explored the differences between heavy and lighter TNC users. Thus, we developed a 20 questions survey that aimed to answer how users make use of TNCs, what their motivations for using TNCs are, and how users perceive TNCs as compared to taxis and public transport.

We then distributed this sample survey to students at the University of Texas at Austin by group-emailing. The purpose of this survey was to test the validity and clarity of the survey questions and design. This sample survey generated over 300 responses. We also shared the sample survey among selected transportation researchers to get their feedback on questions. These results were then used to inform the design of a final survey. Based on the feedback, some questions in the final survey were changed, and a few of the questions were cut as they were unclear.

The professional survey firm QuestionPro conducted the second online survey. The survey population was drawn from QuestionPro's 4 million eligible panelists in the United States

(QuestionPro, 2019). This survey, however, was only distributed to individuals in the four largest MSAs in Texas. Figure 1 shows the these MSAs in the Texas Triangle region. Users who have used a TNC at some point in the past and to be 18 years of age or older are eligible participants. The detailed survey questions and all possible responses are included in the appendix. We conducted a stratified random sampling of eligible users in each MSA. For each MSA, 250 complete responses were collected, but within the MSA all users were randomly sampled if they were eligible to participate.
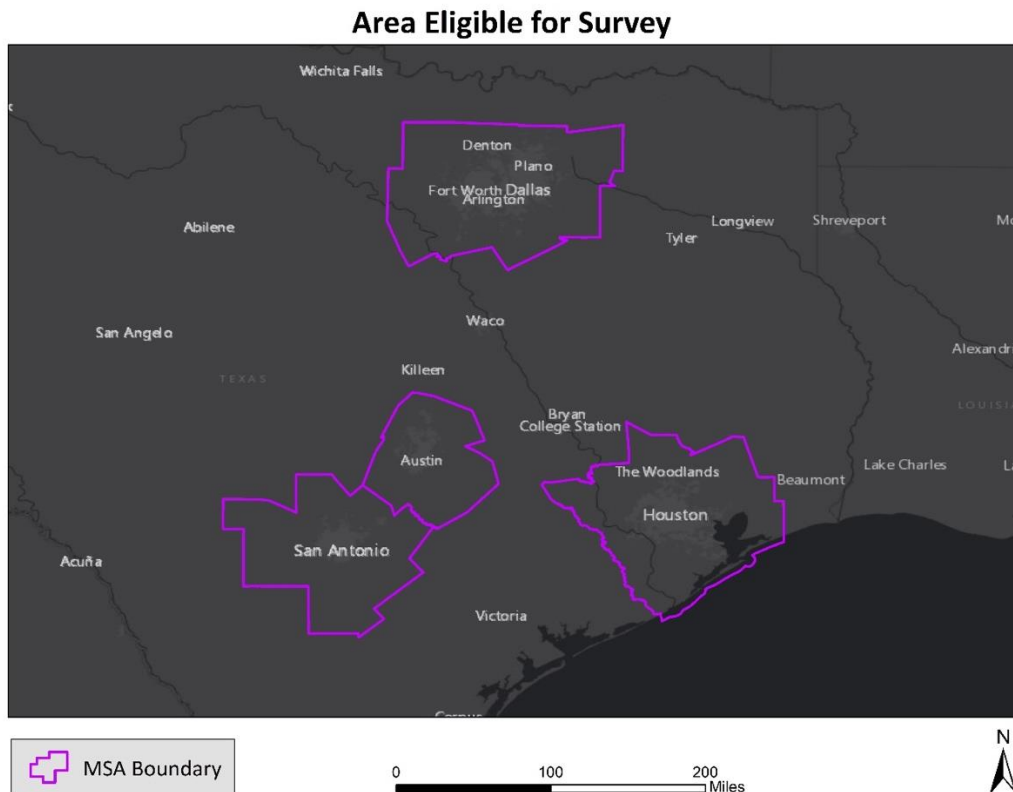
Figure 1 Four Eligible Study Areas for TNC Survey

2.5 Results

From the panel survey, we obtained1000 completed responses. Seventeen responses were excluded for different reasons. For example, one participant marked that they were under 18 years of age, so we excluded this response. Additionally, respondents who did not specify their sex or ethnicity were excluded from the final analysis to make interpretation of the results easier. In the

end 983 valid samples were included in the analysis. Detailed questions of the final survey were presented in the Appendix.

Data on the respondents' demographics is displayed below in Table 1. Overall, respondents were 71.44% female and 28.56% male. In terms of age, no single age category was dominant, though a plurality of users responded that they were between 36 and 45, which may reflect the fact that TNCs are mature businesses and are no longer only appealing to young adult population, defined here as 18 to 34 years old. Fifty three percent of the respondents were White. The next largest demographic group was Hispanic (24% of respondents). Regarding income, 27% of respondents made less than $25,000 in 2018. The rest of the responses were evenly distributed, except only about 4% of respondents made $150,000 or more last year. Exactly half of all respondents had less than a bachelor's degree. Finally, and importantly, 88% of respondents reported that they have regular vehicle access. This trend may have important implications for planning and policy.

TABLE 1 Demographics of Respondents

Demographic Variable	Number of Responses	Percent of Respondents
Age		
Under 18	0	0.00%
18-22	149	15%
23-25	98	10%
26-30	185	19%
31-35	158	16%
36-45	211	21%
46-55	106	11%
55+	76	8%
Ethnicity		
White	519	53%
African American or Black	145	15%
Hispanic or Latino/a	234	24%
Asian or Pacific Islander	60	6%
Other	25	3%

Demographic Variable	Number of Responses	Percent of Respondents
Prefer not to say	0	0.00%
Gender		
Male	283	29%
Female	708	71%
Education		
Some high school or less	38	4%
High school diploma or equivalent (GED)	185	19%
Some college, no diploma	268	27%
Associates or vocational degree	148	15%
Bachelor's degree	239	24%
Master's degree	78	8%
Doctoral or Professional degree (PhD, MD, JD, etc.)	27	3%
Vehicle Access		
Yes	862	88%
No	121	12%
Income		
less than $25,000	261	27%
$25,000 to $34,999	148	15%
$35,000 to $44,999	100	10%
$45,000 to $54,000	115	12%
$55,000 to $74,000	131	13%
$75,000 to $99,999	103	10%
$100,000 to $150,000	85	9%
$150,000+	40	4%

2.6 Usage of TNCs

This survey asked respondents several questions concerning their usage of TNCs. Table 2 summarizes these responses. Overall, 43% of respondents used TNCs less than once a month. When grouping respondents together, most respondents (85%) used TNCs no more than 3 times per month. Respondents (59%) most frequently use TNCs on non-workdays. About 33% of respondents use TNCs on workdays, and the remainder use them on holidays. Respondents use them most often in the evenings and night, and the most common response for when respondents use TNCs was between the hours of 8 pm and 10 pm. Lastly, about 37% of respondents estimated their average trip length was 11-15 minutes, which was the most common response. In total, 87% of respondents estimated that their average trip was between 5 minutes and 20 minutes, indicating that in general, TNC trips are relatively short in length, which has confirmed findings from several previous studies (SFCTA, 2017, Jiao et al, 2020).

TABLE 2 TNC Usage Information

Demographic Variable	Number of Responses	Percent of Responses
Frequency of Use		
Less than once a month	419	43%
Once a month	155	16%
2-3 times a month	257	26%
Once a week	38	4%
2-3 times a week	85	9%
Daily	19	2%
More than once a day	10	1%
Time of Day Used		
Early morning (5am-7am)	168	7%
Morning (8am-10am)	271	11%
Early afternoon (11am-1pm)	213	9%
Afternoon (2pm-4pm)	281	12%
Early evening (5pm-7pm)	388	16%
Evening (8pm-10pm)	487	20%
Night (11pm-1am)	409	17%

Demographic Variable	Number of Responses	Percent of Responses
Late night (2am-4am)	218	9%
Primarily Day of Week Used		
Work days	329	33%
Non-work days	581	59%
Holidays	73	7%
Length of Typical Trip		
Less than 5 minutes	32	3%
5-10 minutes	216	22%
11-15 minutes	360	37%
16-20 minutes	251	26%
21 minutes or longer	124	13%

2.7 Motivations for Usage and Trip Purpose

This survey also included the motivations for choosing to use TNCs. When asked what their most frequent trip purpose is, 37% of respondents replied that they use TNCs for trips to bars, restaurants, or other entertainment venues, by far the most common response. The next most common trip purpose was for emergencies (e.g. Medical). We also asked users to rate what they value most in with regards to TNCs. The most important factor among users was safety, with reliability a close second.

2.8 Relationship to Other Transportation Services

This survey asked respondents questions related to how their TNC usage interacts with various other modes of transportation. First, we asked respondents how often they use TNCs to connect to other transportation modes. We found that a near majority (42%) of respondents never use a TNC to connect to another form of transportation, which indicates that many users are likely using TNCs to connect directly to their destination and not to solve first mile/last mile issues, as some have claimed. Additionally, 48 % of survey takers that use a TNC to connect to another form of transportation only do so a few times a month or less. When people do use TNCs to connect

with other transport modes, many users (27%) use TNCs to connect the airport with bus stations or parked personal vehicles.

Next, we asked respondents to compare TNCs to both conventional taxis and public transport. A clear majority of people find that TNCs are more convenient than public transport, with 79% of people choosing this option. The same is true of TNCs compared to conventional taxis, with about 69% of people rating TNCs as more convenient than conventional taxis. About 28% of people consider TNCs more expensive than public transport, and about 40% of people considered TNCs less expensive than conventional taxis. Finally, along the last dimension, reliability, 28% of people consider TNCs more reliable than public transport, and 30% of people consider them more reliable than conventional taxis.

2.9   TNCs and Perceived Trip Making Activity

Finally, we asked respondents to detail what they believed the relationship between their usage of TNCs and their trip making habits to be. In total, 61% of respondents said that they believed that TNCs were convenient for traveling. We also found that 48% of respondents believed that they made more trips because of the availability of TNCs. Even though this merely self-reported data, this finding suggests that there is significant induced demand because of TNCs.

To further contribute to our collective understanding of TNCs, we separated user survey data by usage frequency. As discussed above, little if any research has been done looking at the difference between heavy TNC users and more regular-frequency users. First, we developed a classification scheme based on the frequency of usage among surveyed users and our intuition. Most users (88%) of respondents use a TNC once a week or less. Thus, we classified a heavy user as someone who used a TNC two times a week or more. While based strictly on the data, it might be possible to argue that a heavy user is some who uses a TNC at least once a week, we opted to include these people in the regular user category, which is because it would make sense intuitively that using a TNC once a week, particularly on weekend nights, would be a regular use case for many people that are not habitually heavy users. We found that that 88.5% of users were non-heavy users, and 11.5% of users were heavy users. We then compared our survey results between the two groups.

First and foremost, among our findings is that heavy users have many different patterns of use compared to non-heavy users. Heavy users have a much greater preference for using these services during weekdays, as compared to regular users. Entirely, 69% of heavy users use TNCs primarily on weekdays, whereas non-heavy (normal) users display opposite patterns of usage. About 29% of regular users use TNCs on workdays, and 63% of them use them on non-workdays. This result makes sense since the purposes of TNC trips are different among heavy users and regular users. Heavy users are far more likely to use TNCs for commuting purposes, as shown in (Figure 2). They also used TNCs to go to Bars or restaurants, run personal errands or connect to other transportation services. It also showed the number one usage purpose for TNCs was to go to Bars or restaurants for all users regardless heavy and non-heavy users.
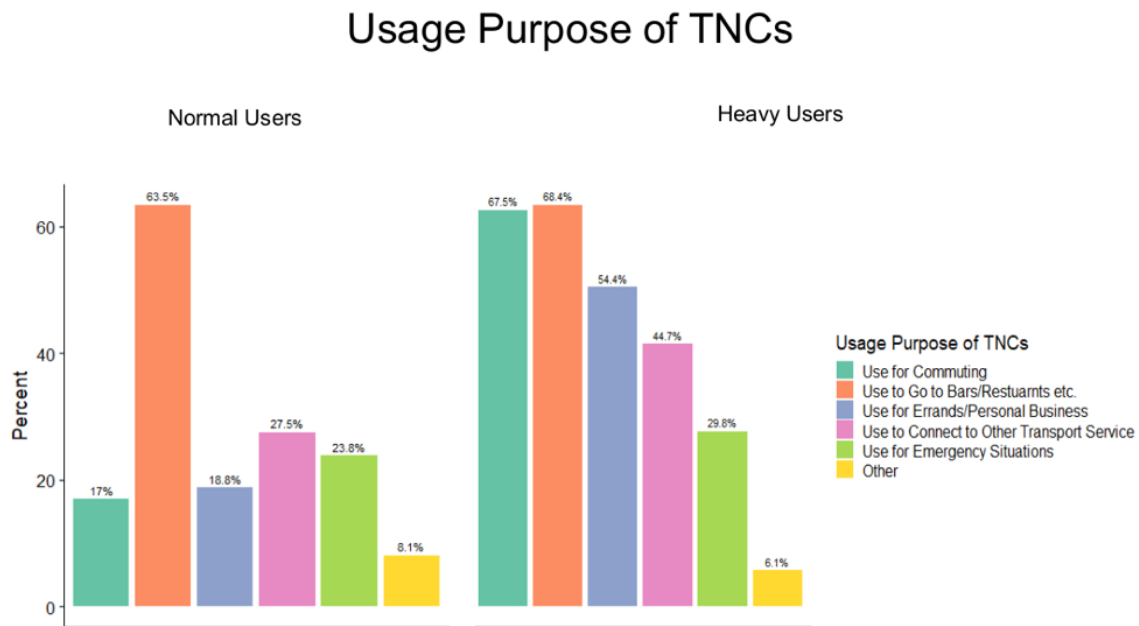

Figure 2 Usage Purpose for TNCS

In terms of demographics, the differences between the two groups are displayed below in Table 3. We find that overall heavy users tend to be wealthier, more educated, and to have less vehicle access. Intuitively these results make sense as one would expect heavy users to have more disposable income if they are using TNCs, which are expensive, compared to public transit. Additionally, it makes sense they have less vehicle access as they are likely using TNCs for some trips that car owners would make otherwise. Heavy TNC users also include more minorities than regular users overall.

TABLE 3 User Statistics for Regular and Heavy Users

Demographic Variable	Non-Heavy Users	Heavy Users
Age	Percent of Respondents	
Under 18	0	0
18-22	16%	7%
23-25	10%	11%
26-30	19%	21%
31-35	15%	28%
36-45	21%	26%
46-55	12%	5%
55+	9%	1%
Ethnicity		
White	54%	46%
African American or Black	14%	21%
Hispanic or Latino/a	24%	19%
Asian or Pacific Islander	6%	10%
Other	2%	4%
Sex		
Male	27%	56%
Female	74%	44%
Education		
Some high school or less	4%	2%
High school diploma or equivalent (GED)	19%	19%
Some college, no diploma	28%	20%
Associates or vocational degree	15%	17%
Bachelor's degree	24%	25%
Master's degree	8%	11%
Doctoral or Professional degree (PhD, MD, JD, etc.)	2%	6%

Demographic Variable	Non-Heavy Users	Heavy Users
Vehicle Access		
Yes	89%	81%
No	11%	19%
Income		
less than $25,000	28%	17%
$25,000 to $34,999	15%	16%
$35,000 to $44,999	10%	9%
$45,000 to $54,000	12%	11%
$55,000 to $74,000	13%	17%
$75,000 to $99,999	10%	12%
$100,000 to $150,000	8%	12%
$150,000+	4%	7%

2.10 Conclusions

Overall, this study detailed several interesting findings. We have conducted one of the first extensive surveys of TNC users outside of California. We have used our survey findings to develop a profile of heavy TNC users, a classification that has not been examined in isolation before, from an academic perspective. Overall, our findings have several important implications for planning and policy.

First, our findings suggest that, in general, TNCs are providing alternative transportation service (besides public transportation) to most users, particularly on nights and weekends for leisure purposes. Thus, TNCs may be a critical form of transportation for urban residents that provide a 'missing link' when driving is not possible, and public transport is inadequate. Cities might also consider partnering with TNC companies to identify and fill gaps in existing public transport services as, for example, Washington DC is considering doing (Siddiqui, 2019). Based on our findings, this might allow both entities to contribute to strengthening the efficiency and breadth of urban transportation. Public transit requires large amounts of resources to run, especially late-night service when TNC usage is most popular, and so a cooperative relationship between public services and TNCs would promote an effective way for private services to supplement local

transit; however, our findings also suggest that there is a small group of people who are using TNCs at high levels. These people, as outlined in the results section, are far more likely to use TNCs to commute and to use them on weekdays, presumably integrating them into their regular routines.

Additionally, our research raises some interesting questions and directions for further research. It is worth investigating why heavy users are choosing to use TNCs for commuting purposes, as TNCs are expensive on a cost per minute basis (Schwieterman, 2019). It would also be worth examining what percent of overall TNC trips were generated by these heavy users, as they may contribute to additional overall VMT. Cities and planning officials should better attempt to understand why these people are using TNCs regularly instead of opting for more cost-effective options like public transport.

The main challenge for cities and regulatory officials with regards to TNCs is how to maximize their benefits while minimizing drawbacks. Cities need to understand why some people are using TNCs, a more expensive options than public transit, for commute purpose. Policymakers should help to maximize the number of people in each TNC vehicle, such as subsidizing shared TNC rides and working with the TNC provider companies to encourage the usage of services like UberPool and Lyft Line. Promoting these carpooling options can further minimize the congestion TNCs often add. Cities should consider the fact that TNCs can provide valuable supplemental service for public transit. TNCs can likely provide quick and relatively cheap service to people in parts of the city or times of day when public transport is inadequate.

Overall, our study finds several things. TNCs are mostly being used for occasional travel, on weekends, and for leisure-oriented trips, at least in Texas Triangle. They also are likely adding more VMTs to the transport system in Texas and inducing travel, as nearly half of respondents believe they make more trips because they have access to TNCs. Finally, a small group of heavy users appear to be using TNCs for regular commuting, which does not appear to be the case with most regular users. These heavy users present special issues for the management of TNCs in cities and should be treated as a distinct group in further studies.

2.11 Implications for Megaregions

First, our primary finding with this study is that few people are regular users of TNCs, and most people use them for leisure travel on weekends. This implies that TNCs are a sort of supplemental urban transport service, very similar to taxis. Additionally, most of the trips (over 50%) were 20 minutes or less in length, which implies most trips are relatively local in nature. Thus, TNCs are likely an alternative tool for linking major areas within megaregions.

Second, based on the above findings we see that most TNCs trip are unlinked leisure trips. Thus, within this study context, TNCs might not be an effective first/last mile solution for public transport services. Again, as mentioned above our results imply that TNCs are an alternative form of transportation. Few people appear to be regularly using to connect to public transport or other transportation services. Therefore, policymakers must consider how much they want to encourage TNC travel if many of the trips are unlinked in nature. Additionally, policies should be crafted to ensure that TNCs are providing this supplemental service in the most effective manner possible.

Third, from our survey we found that the vast majority of people (near 80% for some questions) responded that TNCs were more convenient and/or more reliable than public transport. This suggest that public transport is not adequate for much of the general public or at least many people perceive public transit to be inadequate. Therefore, planners and policy makers should work to better understand why public transport is not meeting users. Overall, this study provides some useful insight into how people are utilizing TNCs, how they value TNCs compared to public transportation and conventional taxis, and how heavy and light users compared to each other within the Texas Triangle. Our study finds the most people use TNCs at night and for leisure purposes. Heavy users are much more likely to use these services to connect to public transit or for commuting purposes, however.

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Appendix Survey Questions

1.   Have you ever used a ride-hailing service like Uber or Lyft?

(Yes/No)

2.   What is your age?

(Under 18; 18-22; 23-25; 26-30; 31-35; 36-45; 46-55; 55+)

3.   What is your ethnicity?

(White; African American; Hispanic or Latino; Asian or Pacific Islander; Other; Prefer not Say)

4.   What is the highest level of education you have completed?

(Some high school or less; High school diploma or equivalent (GED); Some college, no diploma; Associates or vocational degree; Bachelor; Master; Doctoral or Professional degree (PhD, MD, JD, etc))

5.   Do you own or have regular access to a personal vehicle?

(Yes/No)

6.   What was your income last year?

(Less than $25,000; $25,000 to $34,999; $35,000 to $44,999; $45,000 to $54,999; $55,000 to $74,999; $75,000 to $99,999; $100,000 to $149,999; $150,000+)

7.   What is your sex?

(Male; Female; Prefer not Say)

8.   Which of the following cities do you live in or closest to?

(Austin; Dallas-Fort Worth; Houston; San Antonio)

9.   Approximately how often do you use ride-hailing services like Uber or Lyft?

(Less than once a month; Once a month; A few times a month; Once a week; 2-3 times a week; Daily; More than once a day)

10.   Which of the following most accurately describes your usage of ride-hailing services like Uber and Lyft? (Check all that apply)

(Use for commuting to work or school; Use for trips to bars, restaurants, and other entertainment venues; Use for errands or personal business; Use to connect to other transportation services (trains, airport, bus, etc…); Use for emergency situations; Others)

11.   What time of day do you use ride-hailing services like Uber and Lyft (check all that apply)?

(Early morning 5-7am; Morning 8-10am; Early afternoon 11-1pm; Afternoon 2-4pm; Early evening 5-7pm; Evening 8-10pm, Night 11-1am; Late night 2-4am)

12.   When do you primarily use ride-hailing services like Uber and Lyft?

(Workdays; Non-workdays; Holidays)

13.   In your estimation, how long is your typical ride-hailing (Uber/Lyft) trip?

(Less than 5 minutes; 5-10 minutes; 11-15 minutes; 16-20 minutes; 21 minutes or longer)

14.   How often do you use ride-hailing services like Uber or Lyft to connect to another mode of transportation (such as a bus, rail line, personal vehicle, airport etc.)?

(Never, Once a month; A few times a month; Once a week; 2-3 times a week; Daily; More than once a day)

15.   If you use ride-hailing services like Uber or Lyft to connect to another mode of transportation, which mode do you most frequently connect to?

(Bus; Rail Line; Parked personal vehicle; Bicycle; Airport; Other; I do not use these services to connect to other transportation modes)

16.   How important are the following factors to you when using ride-hailing services like Uber and Lyft?

16.1   Cost; (Not important; Slightly important; Neutral; Important; Extremely Important)

16.2   Reliability of service; (Not important; Slightly important; Neutral; Important; Extremely Important)

16.3   Travel time; (Not important; Slightly Important; Neutral; Important; Extremely Important)

16.4   Safety; (Not Important; Slightly Important; Neutral; Important; Extremely Important)

16.5   Comfort; (Not Important; Slightly Important; Neutral; Important; Extremely Important)

17.   What is your primary motivation for using ride-hailing services like Uber/Lyft?

(Cost; Convenience; Total travel time; Safety; Other)

18.   In your opinion, compared to public transit, ride-hailing services like Uber and Lyft are:

(More convenient; Less convenient; More expensive; Less expensive; More reliable, Less reliable)

19.   In your opinion, compared to traditional taxis, ride-hailing services like Uber and Lyft are:

(More convenient; Less convenient; More expensive; Less expensive; More reliable, Less reliable)

20.   Do you believe you make more trips because of ride-hailing services like Uber and Lyft?

(Yes; No; Unsure)

21.   Do you believe that ride-hailing services like Uber and Lyft help you go to places that you would not otherwise go to if Uber/Lyft did not exist?

(Yes; No; Unsure)