

# Older Drivers and Transportation Network Companies: Investigating Opportunities for Increased Safety and Improved Mobility

JUNE 2019 | Final Report



## **Disclaimer**

*The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated in the interest of information exchange. The report is funded, partially or entirely, by a grant from the U.S. Department of Transportation's University Transportation Centers Program. However, the U.S. Government assumes no liability for the contents or use thereof.*

## TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. 02-016	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Older Drivers and Transportation Network Companies: Investigating Opportunities for Increased Safety and Improved Mobility		5. Report Date June 2019	
		6. Performing Organization Code:	
7. Author(s) <a href="#">Melissa Tooley</a> <a href="#">Johanna Zmud</a> <a href="#">Benjamin Ettelman</a> <a href="#">Maarit Moran</a> <a href="#">Laura Higgins</a> <a href="#">Ashley Shortz</a> <a href="#">Eric Wheeler</a>		8. Performing Organization Report No. Report 02-016	
12. Sponsoring Agency Name and Address Office of the Secretary of Transportation (OST) U.S. Department of Transportation (US DOT) State of Texas		10. Work Unit No.	
		11. Contract or Grant No. 69A3551747115/Project 02-016	
12. Sponsoring Agency Name and Address Office of the Secretary of Transportation (OST) U.S. Department of Transportation (US DOT) State of Texas		13. Type of Report and Period Final Research Report	
		14. Sponsoring Agency Code	
15. Supplementary Notes This project was funded by the Safety through Disruption (Safe-D) National University Transportation Center, a grant from the U.S. Department of Transportation – Office of the Assistant Secretary for Research and Technology, University Transportation Centers Program, and, in part, with general revenue funds from the State of Texas.			
16. Abstract Transportation network companies (TNCs) such as Uber and Lyft offer an increasingly popular alternative to driving a personal vehicle. This project investigated the potential of TNCs to increase the safety and enhance the mobility of older adults who are experiencing a decline in driving ability. Interviews with commercial and non-profit transportation providers and focus groups of adults ranging from age 65 to over 85 identified attitudes and perceptions toward TNCs and related services targeting senior adults, as well as ongoing barriers to TNC use by this demographic. Barriers include insufficient familiarity and comfort with using smartphone applications, a lack of knowledge among older adults about how TNCs operate, and lack of availability of TNC services in many rural areas. Increased availability of TNC services targeted toward older adults may help to overcome some of these barriers. The project team developed outreach and education materials for older adults on how to access and use TNC services.			
17. Key Words transportation network companies, older drivers, mobility, aging		18. Distribution Statement No restrictions. This document is available to the public through the <a href="#">Safe-D National UTC website</a> , as well as the following repositories: <a href="#">VTechWorks</a> , <a href="#">The National Transportation Library</a> , <a href="#">The Transportation Library</a> , <a href="#">Volpe National Transportation Systems Center</a> , <a href="#">Federal Highway Administration Research Library</a> , and the <a href="#">National Technical Reports Library</a> .	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 29	22. Price \$0

## Abstract

*Transportation network companies (TNCs) such as Uber and Lyft offer an increasingly popular alternative to driving a personal vehicle. This project investigated the potential of TNCs to increase the safety and enhance the mobility of older adults who are experiencing a decline in driving ability. Interviews with commercial and non-profit transportation providers and focus groups of adults ranging from age 65 to over 85 identified attitudes and perceptions toward TNCs and related services targeting senior adults, as well as ongoing barriers to TNC use by this demographic. Barriers include insufficient familiarity and comfort with using smartphone applications, a lack of knowledge among older adults about how TNCs operate, and lack of availability of TNC services in many rural areas. Increased availability of TNC services targeted toward older adults may help to overcome some of these barriers. The project team developed outreach and education materials for older adults on how to access and use TNC services.*

## Acknowledgements

*This project was funded by the Safety through Disruption (Safe-D) National University Transportation Center, a grant from the U.S. Department of Transportation – Office of the Assistant Secretary for Research and Technology, University Transportation Centers Program, and, in part, with general revenue funds from the State of Texas. The researchers also wish to recognize the contributions of subject matter experts at AARP, who contributed their time and effort to provide input and guidance for this study.*

# Table of Contents

---

<b>INTRODUCTION .....</b>	<b>1</b>
<b>BACKGROUND .....</b>	<b>1</b>
Aging Population .....	1
TNC Services.....	2
Current TNC Use by Older Adults .....	3
TNC Services and Programs for Older Adults .....	3
Specialized TNC Services.....	3
TNC Dispatch Services.....	4
Potential Safety Benefits of TNC Use.....	4
Reduced Risk of Crashes .....	4
TNC Safety Features.....	5
Barriers to TNC Use for Older Adults.....	6
Lack of Knowledge.....	6
Trust and Risk Aversion to TNCs.....	7
Technology Challenges.....	7
Availability (Geography).....	7
Affordability .....	8
<b>METHOD .....</b>	<b>8</b>
<b>RESULTS .....</b>	<b>10</b>
Expert Interview Results.....	10
Agency Interviews .....	10
TNC Interviews.....	13
Focus Group Results .....	14
Current Mobility Options.....	14
Knowledge and Opinions of TNCs .....	15
Facilitating Usage of TNCs .....	18
<b>OUTREACH MATERIALS .....</b>	<b>18</b>
<b>CONCLUSIONS AND RECOMMENDATIONS .....</b>	<b>19</b>

<b>ADDITIONAL PRODUCTS.....</b>	<b>19</b>
Education and Workforce Development Products .....	19
Technology Transfer Products .....	19
Data Products.....	20
<b>REFERENCES.....</b>	<b>21</b>
<b>APPENDIX A: EXPERT INTERVIEW GUIDE.....</b>	<b>25</b>
Questions for TNCs .....	25
Questions for Service Providers .....	26
<b>APPENDIX B: DISCUSSION GUIDE FOR FOCUS GROUPS.....</b>	<b>27</b>
Welcome/Instructions (5 min) .....	27
Ground Rules .....	27
Warm-Up (10 min) .....	27
Current Mobility Options (10 min).....	28
Knowledge and Opinions of TNCs (40 minutes).....	28
Pros/Cons of TNCs and Other Options (15 minutes) .....	28
Facilitating Usage of TNCs (15 minutes) .....	29

# List of Tables

---

Table 1. Sample of Interview Questions Used In Expert Interviews..... 9

Table 2. Focus Group Participant Information ..... 10

Table 3. Sample of Discussion Questions Used in Focus Groups ..... 10

Table 4. Alternative Mobility Options..... 14

Table 5. Awareness and Use of TNC Services ..... 15

Table 6. Benefits of Using TNCs..... 16

Table 7. Barriers to TNC Use ..... 17

# Introduction

---

On-demand ride services provided by transportation network companies (TNCs), such as Uber and Lyft, are an increasingly utilized transportation option. TNCs are taxi-like services accessed through a Smartphone application (app) that have found their market niche primarily in urban areas. Unlike most conventional taxi or shuttle services, would-be passengers request a real-time ride through the app, which then identifies the passenger's pickup location using the smartphone's Global Positioning System (GPS) and matches the passenger with a driver. For older populations, TNCs have the potential to provide enhanced mobility for a range of transportation needs, including healthcare appointments, necessary errands, and social opportunities. TNCs may also provide a safer alternative to driving a personal vehicle for older adults who are experiencing a decline in driving ability. The purpose of this study is to gain a better understanding of both the potential benefits and barriers of TNCs for older adults in order to effectively promote them as a viable mobility option.

The study addressed the following research questions:

- What are the factors influencing the adoption and use of TNCs by older populations?
- What would be the most effective ways of mitigating perceived negative influences?

## Background

---

### Aging Population

Currently, 49.2 million individuals, or approximately 15% of the U.S. population, are aged 65 and older (1). The U.S. Census Bureau predicts that by the year 2060, 98.2 million people in the United States will be age 65 and older, which will make up nearly 25% of U.S. residents. Additionally, of the 98.2 million people that are projected to be 65 and over, 19.7 million will be in the 85 and older age bracket (2). Recognizing the rapid growth of the aging population, researchers have looked closely at the mobility needs of older adults. Specifically, it is critical to consider that different age groups among older adults have different mobility needs.

Gerontologists typically classify old age into three segments, with older adults aged 65–75 being characterized as “young-old,” 75–85 characterized as “old,” and 85+ characterized as “old-old” (3). While there is wide individual variation among older adults, physical and cognitive challenges that can affect driving and mobility tend to become more prevalent as people age into the “old” and “old-old” segments; nearly all older adults will eventually be faced with mobility challenges. As driving cessation occurs, transportation options become more limited, which can ultimately lead to isolation and deteriorating health and/or quality of life. According to the Surface Transportation Policy Project (2015), more than half of the U.S. non-driving population age 65 and over stays home on any given day because they lack transportation. They make fewer trips to

the doctor (15%), to shop or eat out (59%), and for social, family, and religious activities (65%) than drivers in the same age group (4). The potential for TNCs to provide safe and accessible transportation for older adults may lead to a more mobile and healthier aging population.

In addition to driving cessation, older adults face increasing physical limitations as they age. The physical consequences of aging may make it difficult for older adults to walk, bike, or take transit, which can lead to isolation and difficulty getting to necessary activities like grocery shopping, medical appointments, and social interactions (5; 6). As above, TNCs may help older adults continue to access these necessary activities, even after physical limitations reduce other mobility options.

Finally, as older adults face physical ailments that qualify them for Americans with Disabilities Act (ADA) paratransit services, TNCs have the potential to provide cost-effective access to these services. For transit providers, a paratransit trip can cost more than three times the amount of a fixed-route trip. While ADA regulation is intended to ensure that people, including older adults with limited mobility and limited income, have access to paratransit services, the financial burden transferred to transit providers impacts the quality of the services provided (7). To combat this, some transit providers are partnering with TNCs to provide safe and accessible trips for eligible riders, including older adults. “First and last mile” connections are one type of TNC/transit collaboration that can help mobility-challenged riders reach transit stops that are otherwise too far away to be accessible (8).

## TNC Services

TNCs primarily provide ride-sourcing services that operate much like traditional taxis: a traveler requests a ride and pays for a driver who provides that service. Potential passengers must download a TNC’s application (typically free) to a smartphone, tablet, or computer, and register with a valid credit card. The TNC’s software application facilitates the ride request, connects passengers to a driver, uses GPS to navigate to the pick-up and drop-off locations, and shares the vehicle’s progress and estimated arrival with both driver and passenger. After the trip is complete, the application automatically charges the fare to the linked credit card, logs the trip, and generates a receipt.

The most common type of ride-sourcing offered by TNCs is a curb-to-curb trip for one to three passengers traveling as a group, arranged via a smartphone app. Some TNCs offer additional ride services such as ride-pooling (for riders who are willing to share rides with other customers for a reduced fee), larger-vehicle options for groups of 4 to 6 people traveling as a group, and luxury vehicles for riders willing to pay a premium for a “first-class” ride service. TNC apps allow the companies the flexibility to provide multiple services through the same digital interface. This flexibility allows older adult services to be seamlessly integrated into existing interfaces.

Ride sourcing concepts and technologies are being adapted to meet the needs of various travelers, including the aging population. In addition, TNCs have collaborated with transit agencies, health

care providers, and assisted living facilities to provide innovative approaches for on-demand transportation for older adults.

## Current TNC Use by Older Adults

TNC services have emerged in cities and towns across the country. However, there is limited data regarding the demographics or travel behavior of users. This section summarizes available information on the use of TNCs by older adults. A Pew Research Center survey conducted in late 2015 reported that 15% of U.S. adults have used a TNC. Adults 65 years and older were among the least likely demographic groups to have used a TNC. In 2015, only 4% of adults 65+ had used a TNC (9). A more recent study (10) looked at TNC use in seven major cities across the United States. The study's findings were identical to the Pew findings, in that only 4% of adults 65 and older use TNCs (10). However, as the population ages, older adults will increasingly have Smartphones and will be more likely to have accumulated experience in TNC usage. In addition, as the aging population grows and their mobility need increases, TNCs may become a more prominent transportation option for older adults.

## TNC Services and Programs for Older Adults

TNCs provide a number of programs or service models designed specifically for older adults and passengers with disabilities. While TNCs are designed to be accessed through a Smartphone app, there are examples of TNCs incorporating traditional dispatcher services into services that focus on improving access for older adults who are not comfortable with or capable of digitally hailing a TNC. These services provide older adults with the ability to call operators from a phone to schedule rides with TNCs (as well as taxi companies). The following are examples of specialized TNC services and dispatch programs that provide service to older adults.

### Specialized TNC Services

- UberASSIST, available through the Uber app in 13 U.S. cities, enhances TNC ride sourcing with additional assistance for members of the senior and disability communities in a limited number of cities. Drivers are trained to assist riders into the vehicles and can accommodate folding wheelchairs, walkers, and scooters. (11)
- UberACCESS allows customers to use the Uber smartphone application to order same-day ride service with wheelchair-accessible vehicles in a limited number of cities. Customers request UberACCESS by opening the standard Uber application and typing “access” in the promotional code section. This opens a section of the application that allows customers to request wheelchair-accessible vehicles. (12; 13)
- UberWAV accommodates riders who require wheelchair accessible vehicles with a ramp or hydraulic lift for transportation. Drivers are specially certified to safely drive and assist people with disabilities.
- Lyft Concierge leverages Lyft's large network of partnerships to allow third parties to request rides for older adults (or other users who may need assistance booking rides). It uses a “third-party web request product” that allows partner organizations such as senior

care communities, nonprofit groups, and home care providers to request rides through a web program (Lyft, Inc. n.d., Lyft, Inc. 2016). Family caregivers, however, do not have access.

- SilverRide provides door-through-door TNC service for older adults and others with mobility impairments. It provides both transportation and physical assistance to/from any location. Drivers are licensed, bonded, trained, and insured, including for all activities outside the car. SilverRide only operates in the San Francisco Bay area, Sacramento, and Kansas City.

### **TNC Dispatch Services**

- GoGoGrandparent is a telephone-based dispatch service for Uber and Lyft. The service, which operates in all 50 states, caters specifically to older adults who do not own a smartphone or have difficulty using smartphone applications. Users call GoGo operators, and operators order a ride from a TNC to arrive at the user's home. Operators screen and monitor rides to ensure they are completed safely. Users pay with a credit card over the phone and do not pay the drivers directly. The service charges a small fee for its service plus the fare of the Uber/Lyft ride, and users are quoted fees for rides before they order. (14)
- GreatCall Rides works with Lyft to provide transportation to older adults through Jitterbug phones (simplified cell phones with larger keypads that cater to older adults). It is available wherever Lyft operates. Customers press "0" on the phone and request a ride through an operator; the operator then requests a ride through Lyft's concierge platform. Lyft contacts the assigned driver and informs him or her that he or she will have an older rider, and the rider is sent a text message with information about the driver and the license plate of the car. Drivers can be requested within 10 minutes and scheduled for up to a week in advance. The cost of the ride and fees for scheduling are added to the customer's monthly phone bill.
- RideWith24 was developed by 24Hr Homecare in partnership with Uber. The service partners with the Open Doors Organization to train Uber and taxi drivers to accommodate older passengers who may have physical limitations. The services are available to the public in a limited number of cities through a toll-free number, are offered 365 days a year, and promise single rides, repeated rides, and same-day rides within 15 minutes of a request.

### **Potential Safety Benefits of TNC Use**

TNCs may offer increased safety for older adults who may face increased risks with driving and other modes of travel as they age. As older adults retire from driving, they need alternative transportation options to maintain good physical and mental health (15).

### **Reduced Risk of Crashes**

TNCs are a transportation alternative for older adults who face a higher risk of traffic accidents due to a decline in driving ability. While drivers 65+ have the lowest fatality rate per licensed

driver of any other age group, older drivers have greater crash and fatality rates per mile driven compared to any other age group except for the most inexperienced drivers (aged 25 years or less). This tendency is largely due to the risk of crash increasing after the age of 70, coupled with greater physical frailty in old age with respect to crash forces (16). The National Highway Traffic Safety Administration (NHTSA) reported that in 2015, adults 65 years or older comprised 18% of traffic fatalities and 19% of pedestrian fatalities nationwide, yet accounted for only 15% of the U.S. population (17).

Research suggests that TNC drivers are safe drivers. One study evaluated 1 million trips made by approximately 12,000 drivers (both TNCs and non-TNC drivers) over 15 million miles to compare TNC drivers' behavior to average U.S. drivers'. The study found that based on attributes such as speeding, aggressive driving, phone use, and hard braking, TNC drivers operate vehicles more safely than average drivers. The report concludes that TNC drivers have a vested interest in being good citizens on the road, and the rating system used by TNCs is likely a factor that contributes to TNC drivers' behavior (18).

### **TNC Safety Features**

TNC services include features that may serve to increase safety. Regulations in most U.S. states require that TNC drivers undergo background checks (though not fingerprint background checks), have clear driving records, and, in states where required, a vehicle inspection (19). For example, TNC apps typically identify the driver and vehicle available prior to a ride, including their name, license plate number, photo, and rating. Additional features that can make TNC travel safer for older adults include:

- **Digital Payments** – TNCs facilitate payments through a digital application that offers users both convenience and potential safety benefits. The TNC app stores credit card information and automatically calculates and charges fares for each trip. Cash payments are not accepted, which is cited as a factor that improves safety by decreasing the risk of robbery (20). This payment functionality allows blind or visually impaired users to bypass the often difficult manual financial transaction at the end of a fare (21). However, the prohibition of cash payments can create a different barrier by limiting access to TNC services for individuals who do not, or choose not to use, credit cards.
- **GPS Tracking** – TNC apps use GPS technology to track the location of each trip in real-time and display geographic locations. This information can be shared with a friend or family member who can follow the trip's progress (22).
- **Driver Rating Systems** – At the end of each ride, TNCs allow riders to rate the driver, based on the quality of service provided. This additional level of accountability may combat perceptions held by older adults who feel unsafe riding in a vehicle with a stranger. It has also been argued that TNCs may be safer drivers compared to the general public because they are providing a competitive service where their work is subject to a rating system (23).

In addition to these service features, TNCs may offer additional safety features to address specific concerns. For example, Ride Austin offers a “female mode” that allows females and those who

identify as female to request a female driver to facilitate their ride (24). Similarly, UberASSIST (described above) can mitigate safety concerns that older adults may have about how drivers treat passengers who may need special assistance.

While TNCs offer a number of benefits, there are also areas for improvement. While technology solutions may address some safety concerns, they can create other risks and barriers for older adults who may be less familiar with interacting with a Smartphone or are uncomfortable with these services. In addition, while TNCs are now regulated across nearly all of the United States, the implementation of these regulations is still an evolving process. For example, TNCs have been challenged by regulators and policy makers over their background check processes; Uber and Lyft, for instance, have both enhanced their background check procedures for their drivers in 2018 in response to criticisms that previous procedures were not thorough enough (25) (26). However, neither firm conducts fingerprint background checks. Required training for TNC drivers typically does not include education about working with older adults or individuals with physical or mental limitations.

### **Barriers to TNC Use for Older Adults**

TNCs have the potential to provide safe and accessible transportation for older adults. However, as previously discussed, the limited existing data about users of TNC services suggests that older adults are among the least likely current users.

Recently published research conducted in Canada identified a range of barriers to TNC use by older adults, including lack of knowledge, mistrust of drivers, mistrust of online financial transactions, and technology challenges (27). The study interviewed 72 adults over age 65 in Edmonton, Alberta, Canada, in September 2015 and March 2016. The second phase involved four focus groups with 24 older adults in May 2016 and investigated barriers to using TNC services. Shirgaokar (2017) identifies two key barriers: (1) ambiguity and risk averseness about TNC services, and (2) technology challenges. In addition, a 2018 national survey conducted by AARP found that 94% of Americans age 50 and older have heard of TNC options, 29% have ever used such services, and 68% are not likely to do so in the next year. Most cite lack of need and concerns about privacy and safety as reasons for not using TNC services (AARP 2018).

#### **Lack of Knowledge**

Shirgaokar (2017) found that the older adults interviewed were unclear about many aspects of TNC operations: TNC company structure, offered services, payment methods, how to book rides, and how TNCs estimate fares. TNCs are relatively new transportation providers and have been in operation in the United States for less than seven years. As such, seniors are not alone in lack of knowledge of these services: The Pew Research Center reported that in 2015, 33% of U.S. adults had not heard of ride-hailing apps, such as Uber and Lyft, and 51% had heard of but not used such apps (28). In addition, large TNCs like Uber and Lyft offer multiple types of services and continue to test new service products. This variability and diversity of services may contribute to a lack of knowledge among seniors, as well as among the broader population.

### **Trust and Risk Aversion to TNCs**

Shirgaokar (2017) highlighted a significant focus on trust among the older adult participants. Concerns related to TNCs' status (e.g., licensed, regulated), reports of sexual assault, and pricing systems (e.g., surge pricing). Some of this perceived risk may be mitigated with increased education about the service options, policies, and regulation of TNCs. TNCs are increasingly partnering with organizations familiar to older adults (e.g., hospitals, healthcare providers, etc.), but there is no documented evidence of the success of these efforts to assuage concerns among older adults. Since 2013, 48 U.S. states have introduced legislation to legalize and regulate TNCs. These laws may help to clarify TNC operations and institute consistent requirements for their operations (29).

### **Technology Challenges**

Shirgaokar (2017) identified technology challenges as a principal barrier to TNC use among older adults. Other researchers have found that, while age does not necessarily limit use of technology products, older adults are less likely to use technology compared with younger adults (30).

The Pew Research Center surveys find that 42% of U.S. adults 65 years and older report that they had or used a smartphone in 2016 (31). However, the surveys also highlight that use of smartphones and other digital technologies is increasing among older adults. The proportion of adults 65 years and older who report owning a smartphone increased from 18% in 2013 to 42% in 2016.

Older adults face some unique barriers to technology use. Thirty-four percent of older internet users surveyed by the Pew Research Center report that they have “little to no confidence in their ability to use electronic devices to perform online tasks.” In addition, 48% of seniors say the following statement describes them very well: “When I get a new electronic device, I usually need someone else to set it up or show me how to use it” (31).

TNC services are designed explicitly to leverage mobile smartphone devices and digital applications enabled by those devices. While TNCs are making efforts to expand access through website, phone-based, and dispatcher services, they primarily remain a smartphone-app based service. As such, technological barriers may continue to be an issue in TNC use for older adults in the United States.

### **Availability (Geography)**

For older adults transitioning from driving, the availability of other transportation options can be critical to their quality of life. Rural older adults may live in areas with no public transportation. In addition, rural older adults living in poverty are less likely to have access to a car (32). This lack of transportation options can severely limit their ability to access necessary services and activities and in turn lead to social isolation as older adults live more non-driving years.

TNCs launched in large metropolitan areas, and cities continue to be their primary markets (23). According to the Pew Research Center, TNC use is much higher among urban adults even when

looking at groups that represent early adopters. A 2015 Global Web Index survey found that only 6% of surveyed Uber app users live in rural locations (29). Precise data about the service areas of TNCs are not publicly available, but this suggests that use is still concentrated in urban areas.

### **Affordability**

While TNCs currently offer ride services at lower rates than taxis in many cities, a TNC ride is generally more expensive than public transit alternatives and may be out of reach for many older adults. Shirgaokar (2017) noted that some older adults did not want to pay a fee for booking or to a dispatcher and had concerns about the pricing mechanisms used by TNCs. Even for older adults who are physically and mentally capable of accessing TNC services, cost may be a barrier to use. The issue of affordability is exacerbated when looking at rural geographies, as adults age 60–64 living in rural areas are more likely than older adults living in metropolitan areas to be poor; after age 85, this percentage increases (32).

Financial limitations will be different for different subsets of the aging population as well. Older adults with greater wealth or who are still fully employed may be able to afford TNC services that lower-income seniors cannot afford. Like taxis, TNCs are more expensive than public transportation or riding with friends or family. Finally, the geographic availability of TNC services may be a significant barrier for older adults in rural and suburban regions.

An existing solution to overcoming the affordability barrier is to subsidize or set a cap on the fee that a user must pay for a TNC ride (4). Transit providers and taxi companies provide numerous examples of discounts or vouchers for older adults to subsidize their use of the services. Groups such as Area Agencies on Aging or Medicaid providers often provide these incentives (33).

## **Method**

---

As the literature review portrays, there is little empirical information on aging adults' use of TNC services. This study sought to add to research available by addressing two questions:

- What are the factors influencing the adoption and use of TNCs by older populations?
- What would be the most effective ways of mitigating perceived negative influences?

The research questions were addressed using qualitative research methods, specifically expert interviews and focus groups. Expert interviews were conducted with representatives of TNC providers such as Lyft, Uber, Fasten, SilverRide, and others, as well as key stakeholders including Area Agencies on Aging and human services organizations addressing elderly transportation needs. The purpose of the expert interviews was to gather a systems-level view of transportation needs and services for older people and to discuss challenges faced and recent innovations (successes and failures). A semi-structured interview script guided the interviews so that consistent information was collected. Eleven interviews were conducted (five TNC providers and six human

service organizations) and took, on average, about 60 minutes to complete. Table 1 shows a sample of questions used in the expert interviews. The full interview guide can be found in Appendix A.

**Table 1. Sample of Interview Questions Used In Expert Interviews**

<b>Questions for TNCs</b>
Does your TNC service older adults?
Is there a different application or service model specifically for older adults?
What obstacles has your TNC encountered to providing TNC service to older adults?
<b>Questions for Human Service Organizations</b>
Does your organization provide or facilitate transportation for older adults?
Does your organization partner with senior transportation providers/TNCs to provide transportation for older adults?
What obstacles has your organization encountered in servicing older riders who require transportation services?
What challenges are most frequently reported/communicated by your clients who are seeking transportation services?

The purpose of the focus groups was to identify attitudes toward and barriers to TNC use from the perspective of older adults and to provide insight into the aging population’s mobility alternatives. A series of six focus groups with adults of three different age brackets (total  $n = 57$ ) were conducted in May of 2018: three in Houston, Texas ( $n = 27$ ) and three located in Richmond, Virginia ( $n = 30$ ). Age brackets for each site included (1) young-old (65–74 years old), (2) old (75–84 years old), and (3) old-old (85 years and older); all groups included both men and women.

The two locations were selected to represent different geographic regions as well as a mix of large urban/metropolitan and small urban/suburban communities. The Houston area is served by multiple, widely available transportation services, including social agencies serving senior transportation needs, public transit and paratransit, traditional taxi services, and well-established TNCs. Richmond has sparse transportation options aside from private vehicles.

Focus group participants were selected to include a range of familiarity with smartphones and smartphone applications. An effort was made to include participants in both cities who used transportation options other than personal vehicles, but nearly all participants predominantly drive themselves. This, and the observation that few differences were observed in the abilities and travel habits among participants in the three age groups, is likely due to some selection bias inherent in the focus-group approach to this study. A limitation of the research was that participants in these discussions were all able to travel to a focus group facility and to participate in a 90-minute discussion, meaning that older adults with significant physical and/or cognitive declines were not represented in the participant groups. More information about participants is shown in Table 2.

**Table 2. Focus Group Participant Information**

Location	Group 1 (65–74 years old)	Group 2 (75–84 years old)	Group 3 (85 years and older)
Richmond ( <i>N</i> = 30)	<i>n</i> = 10 8 drive 5 use smartphones	<i>n</i> = 10 9 drive 4 use smartphones	<i>n</i> = 10 9 still drive 1 uses smartphone
Houston ( <i>N</i> = 27)	<i>n</i> = 9 9 drive Some use smartphones (exact number unknown)	<i>n</i> = 8 8 drive 4 use smartphones	<i>n</i> = 10 10 drive 1 uses smartphone

Table 3 shows a sample of the questions discussed in the focus groups. The full discussion guide can be found in Appendix B. The Texas A&M University and the Virginia Tech University Institutional Review Boards approved this project and consent was obtained from participants.

**Table 3. Sample of Discussion Questions Used in Focus Groups**

Current mobility options
What are some of the options for older people who have limited or stopped their driving?
Have you tried to arrange for senior transportation for yourself or a family member?
What are your biggest concerns of not being able to drive due to advancing age or illness?
Knowledge and opinions of TNCs
Have you heard of services like Uber and Lyft, which operate a little like taxi services; however, instead of calling a central taxi-cab company, customers use a smartphone app to request a ride?
What can you tell the others about how such services operate?
Facilitating use of TNCs
What types of information or training materials would be useful to people who are new to using TNCs?
What would be the best way to train people about how to use TNCs and what type of materials would be best?

## Results

### Expert Interview Results

Interviews were conducted with representatives of five TNCs and related services, and with representatives of six public and nonprofit agencies that provide or facilitate transportation for older adults.

### Agency Interviews

Participants included representatives from Feonix: Mobility Rising, Alamo Area Agency on Aging, Rio Grande Area Agency on Aging, North Central Texas Council of Governments (NCTCOG), Brazos Valley Council of Governments (BVCOG), and the St. David’s Foundation.

### Missions and Roles

The Area Agencies on Aging, associated with regional Councils of Government, directly provide or facilitate transportation services to older adults as part of their overall community-wide social services. Feonix is a global nonprofit organization that partners with local organizations and local

volunteers to fill gaps in the existing transportation networks within communities; this includes transportation for older adults. St. David’s Foundation is a nonprofit grant-making organization in central Texas that redistributes profits from St. David’s Healthcare in a five-county area to support seniors aging in place.

### Service Models and Partnering

The interviewed agencies use a variety of service models to transport clients, including the following:

- providing transportation services directly to clients;
- contracting with bus companies to purchase rides for older clients, based on a set number of one-way trips per year;
- contracting with public transit providers on a trip-by-trip basis;
- funding county agencies to provide vans for senior centers; and
- partnering with taxi companies, senior centers, Easter Seals, and other public and private entities to provide accessible service.

One of the interviewed agencies has partnered with a local ride-matching service to provide rides for its older clients; another is pursuing a partnership with a local TNC, so far without success. A third agency has started to promote TNCs as a service option, and has trained older people on TNC use as part of its outreach activities.

### Ridership Trends

The most common trend seen among the transportation providers is increased demand for trips and stagnant or decreased service capacity. For three of the transportation providers, medical trips are the most common trip types requested by older adults. A fourth provider has seen increased demand for all types of trips, including medical, errands, and quality-of-life (socializing/entertainment). One provider is seeing a shrinking base of volunteers to help provide rides as the volunteers themselves age. One interviewee is seeing a positive trend among older riders, particularly those in rural areas, as they become more comfortable with communication technologies that help them reserve rides on their own.

### Service Limitations

The interviewed agencies have different policies regarding the number of trips that a given client can take. Some limit the number of trips per week or per month, which can depend on the client (for instance, one provider allows up to three trips per week for dialysis patients versus two to four trips per month for other clients). Three of the interviewed agencies do not set per-client limits, providing trips on a first-come, first-served basis; this can mean that trip demand from the client base exceeds the available resources. One of these agencies uses local funds to pay for additional trips where possible and also requests reduced fares for clients who must arrange their own rides if the agency’s contract with providers is exceeded.

## Use of Technologies

The emergence of new communication and transportation technologies has been embraced to various degrees by the interviewed agencies. One of the agencies has not perceived many changes as yet pertaining to technology advances; some of the vendors it works with communicate via email, but others still require communication by fax. Another agency has updated its ride scheduling and dispatching software. A third is exploring the customer interfaces offered by companies like RideAustin and Travelocity that allow riders to select specific service options that meet their needs and/or safety/security preferences (such as being able to request a female driver).

## Obstacles to Providing Service to Older Adults

Institutional obstacles mentioned by the agencies included the following:

- implementing effective public outreach and education regarding how their transportation services operate and how to schedule a ride;
- capacity and cost limitations, particularly in rural areas where clients are spread out over large geographic areas;
- adjusting to the schedule needs of particular riders; and
- inability for many county-based providers to cross county lines, making longer-distance trips more complicated.

Challenges and obstacles reported by their clients and riders include insufficient service capacity, the need to schedule trips one to seven days in advance, the absence of evening and weekend service, long wait times, and difficult or confusing transfers between routes or modes. Clients with physical disabilities or limited mobility may need door-to-door assistance, where many paratransit providers can only provide curb-to-curb service. Finally, some clients have a distrust of government and are reluctant to accept government-provided services despite needing those services.

The interviewed agencies have implemented a variety of strategies to mitigate these challenges. Several provide outreach to seniors to determine their needs and/or to educate them on how to use the provided transportation services. Examples include:

- providing a Transportation Resource Guide and an Adult Disability Center to help seniors and their families understand the services that are available to them;
- allowing clients to bring escorts to assist them during their trips;
- providing vehicles that are accessible to people with disabilities; and
- training drivers on how to accommodate the special needs of seniors, including door-to-door assistance if necessary.

Different agencies are taking different approaches to the trip reservation process. One of the interviewed agencies provides a central number for clients to call, and reservation agents then link several different transportation services to provide the needed trips. Two providers are making increased use of advanced technologies, including online customer service interfaces, and focusing efforts on enhancing those interfaces for an increasingly tech-savvy clientele.

Overall service capacity limitations are not easily solved, with some agencies needing to limit the numbers of certain types of trips, and/or the number of trips per client in a given time period.

### Perspectives on TNC Services

The primary concerns that the senior transportation providers expressed regarding TNCs and seniors centered around the ability of TNC drivers to safely accommodate the physical and emotional needs of older people. They emphasized the importance of training in ensuring that drivers understand how to assist older riders in ways that maintain their safety and dignity, and how to be sensitive to specific cultural issues and individual needs. In addition to this specialized training, TNCs must have at least some wheelchair-accessible vehicles to be able to accommodate seniors with mobility limitations.

Another concern is the technical abilities of seniors, as most TNCs require the rider to have some proficiency with smartphone applications. They are, however, anticipating that seniors will become more technologically capable as the Baby Boomers age. Finally, while TNCs are plentiful in many urban areas, there are not many currently operating in rural areas, so they may not be a viable option for that senior market.

### TNC Interviews

Participants included representatives from the TNCs Uber, Lyft, RideAustin, and SilverRide, and from GoGoGrandparent, a telephone-based TNC dispatching and monitoring service for older adults.

### Serving Older Adults

All participants indicated that their respective companies serve older adults. Three out of the five do not specifically track rider demographics, so they do not have information on the proportion of riders who are older adults. One TNC's recent customer survey indicated that 12% of the responding riders were over the age of 50. Furthermore, 30% of the over-50 riders report not owning a personal vehicle and 18% report living with a disability. Another company, which primarily serves older customers, reported that the majority of their clients are over the age of 75, and an additional 30% are between 60 and 75 years old.

### Special Services for Older Adults

The participating TNCs have all developed some type of specific service or accommodation targeting older adults, either as part of their general service model, via one or more specialized classes of service, or through partnerships with other agencies or providers. Accommodations generally address one or more aspects of TNC service that have been identified as obstacles for adults who are older and/or have disabilities, such as providing alternative methods for scheduling trips, ensuring that vehicles are accessible, providing door-to-door service when requested, and/or ensuring that drivers have the necessary skills to assist clients with special needs. One TNC service specifically targeted at an older demographic has resources specifically allocated to ensuring accessibility and drivers trained in providing assistance. Some TNCs have or are pursuing partnerships with local transit or paratransit services to expand service.

## Obstacles and Challenges

Some of the challenges and obstacles faced by TNCs when serving older adults are similar to those identified by the representatives of the more traditional senior-adult transportation services, among them lack of awareness of the services among the targeted population and cost considerations (particularly in rural areas). Resource limitations are also a challenge for TNCs, particularly in the areas of accessible vehicles and drivers with the appropriate training and attitudes needed to provide safe and reliable service to riders with disabilities or special needs.

## Focus Group Results

### Current Mobility Options

All groups in both locations identified friends and family, taxis, and TNCs as being alternatives to driving. All alternative mobility options identified in the groups are shown in Table 4. Almost all participants, regardless of age group and location, expressed lack of independence as being a main concern of not being able to drive. They described it as being “at the mercy of” others like friends and family. They felt as if they were infringing on others’ time and occasionally felt uncomfortable asking others to go out of their way to help. Other mobility concerns included attending medical appointments, social events, and going to the grocery store.

Table 4. Alternative Mobility Options

Location	Group 1 (65–74 years old)	Group 2 (75–84 years old)	Group 3 (85 years and older)
Richmond (N = 30)	Bicycle <b>Bus</b> Churches <b>Family and friends</b> Medical transportation Retirement facilities Social service agencies <b>Taxi</b> <b>TNCs (Uber)</b> Walk	<b>Bus</b> <b>Family and friends</b> Golf carts GRTC CARE Shuttle buses <b>Taxi</b> <b>TNCs (Uber)</b> Vango Walk	Bicycle Churches Commercial pick up services <b>Family, neighbors, friends</b> Institutional vans Local public transit <b>Taxi</b> <b>TNCs (Uber)</b> Vango
Houston (N = 27)	Airport shuttles Bicycle Bus Church <b>Family and friends</b> Local transit (senior bus) Public transit (Metro) Paratransit (Metro Lift) Retirement facilities <b>Taxi</b> <b>TNCs (Uber/Lyft)</b> Train Walk	<b>Family and friends</b> Public transit (Metro) <b>Taxi</b> Texan Plus (NEMT) <b>TNCs (Uber)</b>	Airport shuttles Assisted living shuttles Bus Carpool Charities Texan Plus (NEMT) <b>Family and friends</b> <b>Taxi</b> <b>TNCs</b> Volunteer drivers

\* Bold items are common across all groups in both locations.

## Knowledge and Opinions of TNCs

### TNC Awareness and Use

Overall, most participants were aware of TNCs, particularly Uber (Table 5). Most participants either heard about TNCs from children, grandchildren, younger family members, or in the media, but had very little personal experience using this type of service.

**Table 5. Awareness and Use of TNC Services**

Location	Group 1 (65–74 years old)	Group 2 (75–84 years old)	Group 3 (85 years and older)
Richmond ( <i>N</i> = 30)	<ul style="list-style-type: none"> <li>All aware of TNCs.</li> <li>4/10 report using TNCs.</li> <li>Associated TNCs with younger people and in other cities “where people don’t have cars.”</li> </ul>	<ul style="list-style-type: none"> <li>Most aware of TNCs, particularly Uber.</li> <li>2/10 report using TNCs.</li> <li>Report hearing about TNCs from friends, younger family members, neighbors, and the newspaper.</li> </ul>	<ul style="list-style-type: none"> <li>Most aware of TNCs, particularly Uber.</li> <li>5/10 report using a TNC.</li> <li>Report hearing about TNCs from younger family members, media, and experience using TNCs in other cities (typically with other people).</li> </ul>
Houston ( <i>N</i> = 27)	<ul style="list-style-type: none"> <li>Most aware of TNCs.</li> <li>1/9 report using TNCs.</li> <li>Report knowing what they were via children and grandchildren.</li> </ul>	<ul style="list-style-type: none"> <li>Some aware of TNCs.</li> <li>None had used TNCs.</li> </ul>	<ul style="list-style-type: none"> <li>Some aware of TNCs.</li> <li>1/10 report using TNCs.</li> <li>Majority were not familiar with services.</li> </ul>

### Benefits of TNCs

While participants identified a number of potential benefits to using TNC services (Table 6), common benefits identified across age groups and between locations included the following:

- no need to park;
- less stressful than driving;
- flexibility and ability to gain freedom/independence from relying on others for rides;
- cost-efficient;
- faster than taxi or bus.

**Table 6. Benefits of Using TNCs**

	<b>Group 1 (65–74 years old)</b>	<b>Group 2 (75–84 years old)</b>	<b>Group 3 (85 years and older)</b>
Richmond ( <i>N</i> = 30)	<ul style="list-style-type: none"> <li>• Ease of use/convenience.</li> <li>• Avoiding the need to park.</li> <li>• Not being the driver.</li> <li>• Timeliness.</li> <li>• Perceived safety.</li> <li>• Dependability.</li> <li>• Overcomes the burden of relying on someone else to get to an appointment.</li> </ul>	<ul style="list-style-type: none"> <li>• Widespread availability.</li> <li>• Service for individuals who can't see well.</li> <li>• Faster than bus or taxi.</li> <li>• Lower cost than taxi.</li> <li>• Background checks.</li> </ul>	<ul style="list-style-type: none"> <li>• Lower cost compared to taxis and airport parking.</li> <li>• Not being the driver yourself is less stressful.</li> <li>• Convenience.</li> <li>• Reliability.</li> <li>• Pick up on time at any time.</li> <li>• Freedom and independence.</li> </ul>
Houston ( <i>N</i> = 27)	<ul style="list-style-type: none"> <li>• Quicker than taxis.</li> <li>• Direct route.</li> <li>• Avoid the need to park.</li> <li>• Ability to get rid of car and car insurance.</li> <li>• Provide flexibility (e.g., ride to a location with friends or family but take a TNC back).</li> </ul>	<ul style="list-style-type: none"> <li>• Avoiding the need to park and/or pay to park.</li> <li>• Cheaper than driving own vehicle.</li> </ul>	<ul style="list-style-type: none"> <li>• Door-to-door service.</li> <li>• Convenience.</li> <li>• Experienced drivers.</li> <li>• Know the area.</li> <li>• Direct route.</li> <li>• Payment process.</li> <li>• Prompt arrival times and notification of arrival.</li> <li>• Dependable.</li> </ul>

### Barriers to Use

The most prevalent barrier to TNC use, identified across all groups in both locations, was the need for a smartphone. Many participants currently did not have a smartphone, and most of those had no desire for one. One participant in group 1 in Richmond did not have a mobile phone, only a landline phone. Another major barrier, among those who did own a smartphone, was a lack of knowledge of how to use the applications.

Group 2 in Richmond discussed the cleanliness and comfort of the vehicle itself. They questioned whether the vehicle was going to be too high or too low for them to comfortably access. Another question discussed in group 1 in Houston was whether TNC drivers were able to help load oxygen tanks or walkers. They wondered if this was an insurance liability for drivers.

Cost and payment methods were additional barriers. Group 3 in Richmond noted that if “faced with necessity” a person will choose the “best alternative within means,” meaning that if cost was too high they would not use TNCs. Additionally, group 2 in Houston did not like the idea of having to use a credit card. They felt as though their financial information might not be secure if entered online. They also wondered if drivers could see their credit card information. A complete list of barriers identified is displayed in Table 7.

Table 7. Barriers to TNC Use

	Group 1 (65–74 years old)	Group 2 (75–84 years old)	Group 3 (85 years and older)
Richmond (N = 30)	<ul style="list-style-type: none"> <li>• <b>Need for smartphone.</b></li> <li>• Navigating the app.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Need for smartphone.</b></li> <li>• Navigating the app.</li> <li>• Cleanliness and comfort of the vehicle itself.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Need for smartphone.</b></li> <li>• More comfortable using computer than smartphone.</li> <li>• Cost.</li> </ul>
Houston (N = 27)	<ul style="list-style-type: none"> <li>• <b>Need for smartphone.</b></li> <li>• Navigating the app.</li> <li>• Loading oxygen tanks and walkers.</li> <li>• Not being able to request specific drivers (i.e., those that were helpful before).</li> <li>• Non-English speaking drivers.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Need for smartphone.</b></li> <li>• Distrust in driver.</li> <li>• Credit card for payment.</li> <li>• Drowsy drivers at night.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Need for smartphone.</b></li> </ul>

\* Bold items are common across all groups in both locations.

### Trust in TNC Drivers

Participants in all groups expressed concerns about how TNC drivers are chosen and vetted, and how riders know that the person picking them up (a) is the person they are expecting and (b) has been confirmed to be a safe driver and a person of good character. Some worried about the safety of the vehicles being used and wondered about insurance requirements.

Some of these concerns were alleviated with the explanation that TNCs conduct background checks of potential drivers. Participants also liked the idea of the ratings system for drivers, feeling that it contributes to the safety of TNC riders.

### Importance of “Door-through-Door” Service

Most participants agreed that “door-through-door” service would be a valuable feature for those that need it. However, not all agreed that they would pay for this additional feature. For example, one participant mentioned that a TNC driver helping to carry groceries inside should not cost extra. Another commented that airlines offer help for passengers that need it at no additional charge. One participant expressed concern that the additional charge for door-to-door service may make TNC services too expensive.

Some participants noted that they did not necessarily trust TNC drivers with entering their homes. Others suggested adding an additional “certification” or “badge” for drivers that indicates that they are capable and willing to help older adults if needed.

## Facilitating Usage of TNCs

In order to best facilitate the use of TNCs, participants were asked:

- 1) What type of information or training material would be helpful?
- 2) What are the best ways to train (i.e., format)?
- 3) Where should training take place?

## Preferred Training Content

A common question among participants was simply how these services work. Most wanted step-by-step instruction and to know what tools and services were available. Additional emphasis was placed on the ability to “talk to a real human” if possible to help set up and request rides. Other information requested included:

- What is the cost?
- Who is the driver?
- How are drivers trained or selected, and what are their driving records?
- Is it safe?

A unique perspective offered by the participants aged 85+ in Houston was the suggestion to offer information on how TNC services can be used for medical transport, and how and if TNC drivers have the skills to help older or disabled adults with their specific needs.

## Training Methods and Formats

Training methods suggested by participants included educational seminars or tutorials, television or radio programs, and written material such brochures, pamphlets, and booklets. Many participants recommended training seminars delivered at libraries, community centers, or other public gathering places—or one-on-one tutorials. Another frequent suggestion was articles in periodicals such as the AARP Bulletin, Boomer, Senior Connection, or others that target the older adult demographic. Participants also recommended stand-alone booklets or pamphlets on how to use TNC services.

## Training Locations

A majority of participants suggested holding TNC training at places where people already meet in order to reach as many people as possible. Common suggestions across age groups and locations included churches, community centers, and doctors’ offices.

# Outreach Materials

---

Based on the results of the literature review, expert interviews, and focus group discussions, outreach materials were developed to raise awareness among older adults about the mobility options offered by TNCs and to educate them on how to find and use TNC services. The materials (described further under “Additional Products”) include a short training booklet and accompanying PowerPoint presentation. The booklet and presentation are designed to provide an overview of downloading and using TNC smartphone applications and the process of requesting a ride. The

booklet also includes troubleshooting tips, such as how to cancel a trip, make a complaint about a driver, or recover an item left in a TNC vehicle. Finally, the materials list some of the specialized TNC-related services that may be available. Additionally, an article on TNCs was developed for potential publication in AARP or other publications targeted toward older adults.

## Conclusions and Recommendations

---

While barriers and challenges remain regarding the usability of TNCs among older adults, awareness and training on TNC use may eliminate many of the most common obstacles for physically healthy seniors who are seeking alternatives to driving; telephone-based dispatch services that match drivers and riders can bridge a gap for potential riders who do not use smartphones. For older adults with physical and/or cognitive disabilities, both transportation experts and potential users in the focus groups agreed that TNCs are safe and viable options only if accessible vehicles and specially trained drivers are available and affordable. TNCs also face some of the same challenges as taxi and transit services when operating in rural areas where population density is low and trip distances are long. However, as the population of the United States continues to age, TNCs present a mobility option for older adults that is flexible, convenient, cost-effective, and safe.

Increasing awareness among older adults about the benefits and limitations of TNCs, the basics of how to access and use TNCs, and the availability in some areas of specialized TNC services offers one way to expand mobility options for the aging population. The outreach materials developed as products of this study are intended to advance this opportunity.

## Additional Products

---

The Education and Workforce Development (EWD) and Technology Transfer (T2) products created as part of this project can be downloaded from [the project page on the Safe-D website](#). The final project dataset is located on the Safe-D Collection of the VTTI [Dataverse](#).

### Education and Workforce Development Products

To increase awareness of transportation challenges and options for older people, an education module was developed suitable for use in a classroom lecture at the undergraduate or graduate level. The module consists of a PowerPoint presentation with speaker notes and an accompanying classroom assignment.

### Technology Transfer Products

An article suitable for publication in an industry outreach periodical was developed for further outreach and dissemination. The article is targeted toward older people with the goal of raising awareness of TNCs as a transportation alternative.

A presentation with speaker notes was developed for outreach to older people that addresses the concerns noted in the study and provides a primer on how to use TNCs. A brochure was also developed to supplement the presentation and for general dissemination that emphasizes the main points in the presentation. The presentation and the brochure can be distributed to retirement communities, local government agencies, libraries, community centers, churches, and medical offices. Topics discussed in the presentation and the booklet include:

- What is a TNC?
- How is a TNC different from a taxi?
- How do TNCs work?
- Service options
- Solutions to issues such as cancelling a ride, not being able to find your TNC driver, or accidentally leaving something in the vehicle.

## Data Products

Data from this project include notes from expert interviews with transportation providers and from focus groups with older adults, all collected during May 2018. The public dataset for this project can be found [here](#).

## References

---

1. U.S. Census Bureau. *Annual Estimates of the Resident Population for Selected Age Groups by Sex for the United States, States, Counties and Puerto Rico Commonwealth and Municipalities: April 1, 2010 to July 1, 2016*. . Population Division. 2017.
2. —. Profile America Facts for Features: CB17-FF.08. *Older Americans* . [Online] May 2017 . [Cited: November 29, 2017.] U.S. Census Bureau. PROFILE AMERICA FACTS FOR FEATURES: CB17-FF.08. MARCH 27, 2017. Older Americans Month: May 2017. <https://www.census.gov/content/dam/Census/newsroom/facts-for-features/2017/cb17-ff08.pdf> .
3. Frolik, L. Three States of Old. *Cooperative Aging*. [Online] March 3, 2009. [Cited: April 18, 2017.] <http://www.cooperativeaging.com/2009/03/three-stages-of-old-age.html>.
4. AARP. Waiting for a Ride: Transit Access and America's Aging Population. [Online] 2012. [Cited: December 1, 2017.] <http://www.aarp.org/content/dam/aarp/livable-communities/learn/transportation/waiting-for-a-ride-transit-access-and-americas-aging-population-aarp.pdf>.
5. Whelan, M., et al. *The Elderly and Mobility: A Review of the Literature*. Monash University Accident Research Centre. Victoria, Australia : s.n., 2006.
6. DeGood, K., et al. Aging in Place, Stuck without Options: Fixing the Mobility Crisis Threatening the Baby Boom Generation. *Transportation for America*. [Online] 2011. [Cited: Jan 24, 2017.] <http://www.t4america.org/docs/SeniorsMobilityCrisis.pdf>.
7. United States Government Accountability Office. . ADA Paratransit Services: Demand Has Increased, but Little Is Known about Compliance . [Online] 2011. [Cited: May 8, 2017.] <http://www.gao.gov/assets/660/650079.pdf>.
8. Silvers, Ross. First/Last Mile Partnership with TNC, Taxi and Wheelchair Van. [Online] September 27, 2016. [Cited: August 23, 2018.] <http://onlinepubs.trb.org/onlinepubs/Conferences/2016/DRT/GCohen.pdf>.
9. Smith, Aaron. On-Demand: Ride-Hailing Apps. *Pewinternet*. [Online] May 19, 2016. [Cited: October 10, 2017.] <http://www.pewinternet.org/2016/05/19/on-demand-ride-hailing-apps/>.
10. Clewlow, R. and Mishra, G. *Disruptive Transportation: The Adoption, Utilization and Impacts of Ride-Hailing in the United States*. University of California. Davis Institute of Transportation Studies. 2017. No. UCD-ITS-RR-17-07.
11. Kelly, H. Uber's services for the disabled lack actual cars . *CNN Money*. [Online] May 3, 2016. [Cited: November 11, 2017.] <http://money.cnn.com/2016/05/02/technology/uber-access/index.html>.

12. Uber. Piloting UberACCESS in Houston. [Online] [Cited: May 8, 2017.] <https://newsroom.uber.com/us-texas/piloting-uberaccess-in-houston/>.
13. Begley, D. Disabled Gain Access to Uber Rides. *Houston Chronicle*. [Online] April 13, 2016. [Cited: May 8, 2017.] <http://www.chron.com/news/transportation/article/Disabled-gain-access-with-Uber-pilot-7244375.php>.
14. GoGoGrandparent. Home. [Online] [Cited: September 8, 2017.] <https://gogograndparent.com>.
15. *The Safety and Mobility Patterns of Older Women: Do Current Patterns Foretell the Future?* Rosenbloom, S. and Herbel, S. 4, 2009, Public Works Management & Policy, Vol. 13, pp. 338-353.
16. *Risks older drivers pose to themselves and to other road users.* Tefft, B. C. 6, 2008, Journal of Safety Research, Vol. 39, pp. 577-582. doi: 10.1016/j.jsr.2008.10.002.
17. National Highway Traffic Safety Administration. Older Population. U.S. Department of Transportation. [Online] May 2017. [Cited: Feb 2, 2017.] [https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/2015\\_traffic\\_safety\\_fact\\_sheet\\_older\\_population.pdf](https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/2015_traffic_safety_fact_sheet_older_population.pdf).
18. Bezard , Gwenn. *Driving Analytics: Ridesharing Drivers are Safer than Average American Drivers*. Aite Group LLC. 2016.
19. Moran, Maarit. *Policy Implications of Transportation Network Companies*. Texas A&M Transportation Institute. College Station, Texas : s.n., 2016.
20. Feeney, Matthew. Is Ridesharing Safe? . *Cato Institute*. [Online] January 27, 2015. [Cited: December 1, 2017.] <https://www.cato.org/publications/policy-analysis/ridesharing-safe>.
21. Uber, Inc. Accessibility at Uber. *Uber*. [Online] [Cited: November 30, 2017.] <https://accessibility.uber.com/>.
22. Uber, Inc. Trip Safety. *Uber*. [Online] [Cited: November 30, 2017.] <https://www.uber.com/ride/safety/>.
23. Hall, Jonathan V. and Krueger, Alan B. An Analysis of the Labor Market for Uber's Driver-Partners In The United States. [Online] November 2016. [Cited: June 21, 2017.] <http://www.nber.org/papers/w22843>.
24. Ride Austin. Features. *RideAustin*. [Online] 2017. [Cited: November 29, 2017.] <http://www.rideaustin.com/features/>.
25. Mak, Aaron. Uber is Adding Annual Background Checks for Drivers, Still Won't Require Fingerprints. *Slate (online)*. April 13, 2018.

26. Elias, Paul. Lyft Beefing up Background Checks After Latest Driver Arrest. *U.S. News and World Report*. July 18, 2018.
27. *Which Barriers Prevent Seniors from Accessing Transportation Network Company (TNC) Services? Identifying Ways Forward for a Gendered Policy Approach*. Shirgaokar, M. Washington, DC. : Transportation Research Board Annual Meeting 96th Annual Meeting, 2017.
28. Smith, Aaron. Shared, Collaborative and On Demand: The New Digital Economy. [Online] May 19, 2016. [Cited: June 22, 2016.]
29. McGrath, Felim. The Demographics of Uber's US Users [blog post]. *Global Web Index*. [Online] July 26, 2015. [Cited: July 11, 2017.] <https://www.globalwebindex.net/blog/the-demographics-of-ubers-us-users#>.
30. *Toward a Psychological Science of Advanced Technology Design for Older Adults*. Roger, Wendy A. and Fisk, Arthur D. 2010, *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* , pp. 645-653.
31. Anderson, Monica and Perrin, Andrew. Tech Adoption Climbs Among Older Adults. [Online] May 17, 2017. [Cited: November 1, 2017.] <http://www.pewinternet.org/2017/05/17/tech-adoption-climbs-among-older-adults/#fn-18808-1>.
32. *Advice from Rural Elders: What It Takes to Age in Place*. Dye, C. J., Willoughby, D. F. and Battisto, D. G. 1, 2010, *Educational Gerontology*, Vol. 37, pp. 74-93.
33. Ettleman, B. *Identifying Transportation Solutions That Promote Healthy Aging for Texas*. Texas A&M Transportation Institute. 2017.
34. Lyft, Inc. Lyft Partners to Give Patient Rides. [Online] January 12, 2016. [Cited: November 29, 2017.] <https://blog.lyft.com/posts/nationalmedtrans-concierge>.
35. Lyft, Inc. New Solutions to Keep Seniors Moving. [Online] [Cited: November 29, 2017.] <https://blog.lyft.com/posts/new-solutions-to-keep-seniors-moving> .
36. Rayle, L., et al. App-Based, On-Demand Ride Services: Comparing Taxi and Ridesourcing Trips and User Characteristics in San Francisco.” . [Online] 2014. [Cited: August 4, 2016.] [uctc.net/research/papers/UCTC-FR-2014-08.pdf](http://uctc.net/research/papers/UCTC-FR-2014-08.pdf)..
37. AARP. 2018 Home and Community Preferences: A National Survey of Adults Age 18-Plus. *Accessed October 18, 2018*. <https://www.aarp.org/research/topics/community/info-2018/2018-home-community-preference.html> 2018.

# Appendices

## Appendix A: Expert Interview Guide

---

The following semi-structured interview guide will guide the interviews. In-depth interviews primarily will take place via telephone and average about 60 minutes in length. Participants included professional practitioners from TNCs and from senior service organizations. The information gathered from these experts provided a systems-level view of the topic, discusses recent innovations (successes and failures), and offers the perspectives of organizations (as opposed to individuals).

Topics of the interview guide will include:

- TNC strategies to serve older riders
- Elements of a senior-servicing market
- Opportunities of TNC use among seniors
- Obstacles to TNC use among seniors

### Questions for TNCs

1. Does your TNC serve older riders?
  - a. If yes, when did you start?
  - b. Is there a different application or service model specifically for older adults?
  - c. If yes, describe the service model.
  - d. If no, has your TNC altered its conventional service to better accommodate older adults? Explain.
  - e. If data is available, what proportion of users are over 65?
  - f. Have you ever surveyed your older customers on satisfaction and/or needs?
  - g. If yes, would you share aggregated/overall findings?
2. What obstacles has your TNC encountered to providing TNC service to older adults? (e.g. lack of smart phone use among older adults, accommodating mobility issues)
3. What technologies does your TNC use to serve older adults?
4. What other strategies does your TNC engage to serve older adults?
  - a. Examples might include senior discounts, pick up locations, phone-based dispatch
5. How does your TNC address special needs such as adults with disabilities or personal mobility issues?
6. Does your TNC provide paratransit service or partner with paratransit providers? What about medical transportation providers or other similar organizations?
  - a. If yes, can you describe the business model?
  - b. If no, why not?

## Questions for Service Providers

1. Does your organization provide or facilitate transportation for older adults?
  - a. What is the mission of your organization? Its long-term vision?
  - b. Have your organization's mission, vision, or procedures changed with the emergence of new communication and transportation technologies?
  - c. Have you seen recent changes in the volume or types of trip requests that your organization receives from older adults?
2. Does your organization partner with senior transportation providers? Does your organization partner with a TNC to provide transportation for older adults?
  - a. If yes, describe how these partnerships work (e.g. funding arrangements, memoranda of understanding, customer service model).
3. What type of trips does your organization typically facilitate for older adults?
  - a. Does your organization place limitations on usage by clients (e.g., no more than 2 trips a week, only medical trips)?
4. What obstacles has your organization encountered in servicing older riders who require transportation services? (e.g. service capacity, funding)
  - a. How has your organization overcome those obstacles?
5. What challenges are most frequently reported/communicated by your clients who are seeking transportation services?
  - a. What are some of the strategies they have used to overcome them?
6. What transportation strategies or features have been implemented in your organization to provide service for older adults who require transportation services?

# Appendix B: Discussion Guide for Focus Groups

---

## Welcome/Instructions (5 min)

Thank you all for participating in this discussion group today. My name is [name] and I am a researcher with the Texas A&M Transportation Institute. I will be the moderator for this discussion. My colleague, [name] will be taking notes during our discussion today.

Today we're going to be talking about mobility alternatives to driving one-self. And, how technology is an aid or a barrier to accessing these different options. The information will be used to provide insight into people's future travel behavior.

**Confidentiality:** Despite the fact that my colleagues are taking notes of this discussion, I would like to assure you that the discussion will be anonymous. The notes will contain no information that would allow individual participants to be linked to specific statements. You should try to answer and comment as accurately and truthfully as possible. I and the other focus group participants would appreciate it if you would refrain from discussing the comments of other group members outside the focus group. If there are any questions or discussions that you do not wish to answer or participate in, you do not have to do so; however please try to answer and be as involved as possible.

## Ground Rules

- The most important rule is that only one person speaks at a time. There may be a temptation to jump in when someone is talking but please wait until they have finished.
- There are no right or wrong answers.
- You do not have to speak in any particular order. When you do have something to say, please do so. There are many of you in the group and it is important that I obtain the views of each of you.
- You do not have to agree with the views of other people in the group.
- Does anyone have any questions? [Answers]. OK, let's begin. [Internal Note: Ask for everyone's consent before starting]
- Please feel free to eat, drink, or use the restroom facilities at any time. I encourage you to talk a lot, be candid, and enjoy the discussion.

## Warm-Up (10 min)

1. Let's start the discussion by going around the table and introducing ourselves. Please tell the group your first name, how long you've lived in Houston, and how you usually travel to work, shopping, or appointments.

## Current Mobility Options (10 min)

2. People typically plan for retirement, but it is less common to plan for how we will get around when we can no longer drive a vehicle safely because of advancing age or illness. What are some of the options for older people who have limited or stopped their driving?
  - a. List on flip chart/ white board.
3. Have you tried to arrange for senior transportation for yourself or a family member?
  - a. If yes, what have been some of the challenges you have encountered?
4. What are your biggest concerns of not being able to drive due to advancing age or illness (e.g., lack of independence)

## Knowledge and Opinions of TNCs (40 minutes)

### 5. If TNCs have not been mentioned thus far:

Have you heard of services like Uber and Lyft which operate a little like taxi services; however, instead of calling a central taxi-cab company, customers use a smartphone application to request a ride?

6. Who has used Uber or Lyft?
  - a. What can you tell the others about how such services operate?
  - b. How does this type of service differ from a taxi service?
  - c. What about cost of such a service? [note that in most cities, TNC rates are less expensive than taxi rates]

Now I'm going to show two short videos that describe how these services work.

*Show short TNC videos.*

7. From what you know, what are possible benefits of using a TNC service? [*e.g., payment, security that driver will show up, no parking*]
8. What do you think could be some difficulties or barriers using TNCs? [*e.g., cost contacting/scheduling, payment, security/safety concerns*]
  - a. Probe specifically on the need for a Smartphone.
9. Would you trust a TNC driver with your safety or with that of an elderly family member?
10. TNCs provide curb-to-curb service. How important is it to have “door through door” service? Would you pay extra on top of the regular TNC fare for that?
11. With the TNC app, a passenger rates the driver and the driver rates the passenger. Is this an important feature or not?

## Pros/Cons of TNCs and Other Options (15 minutes)

12. **Go back to Q2 list:** Looking at this list that we generated earlier. What are the top three options for people who have limited or stopped their driving due to advancing age or illness?

13. **For each of the 3:** What are the advantages to using this option relative to the other two?
14. What are the disadvantages to using this option relative to the other two?

### Facilitating Usage of TNCs (15 minutes)

15. What types of information or training materials would be useful to people who are new to using TNCs? If so, what are some topics that should be included in that training? *[e.g., smartphone/application use, finding TNCs in your area, scheduling and paying for a ride, identifying a TNC ride when it arrives]*
16. What would be the best ways to train people about how to use TNCs? What types of materials would be best? *[e.g., brochures/leaflets, hard copy or downloadable; online video; online interactive training, training built into TNC app]*
17. What are the best locations in which to have this information or training?