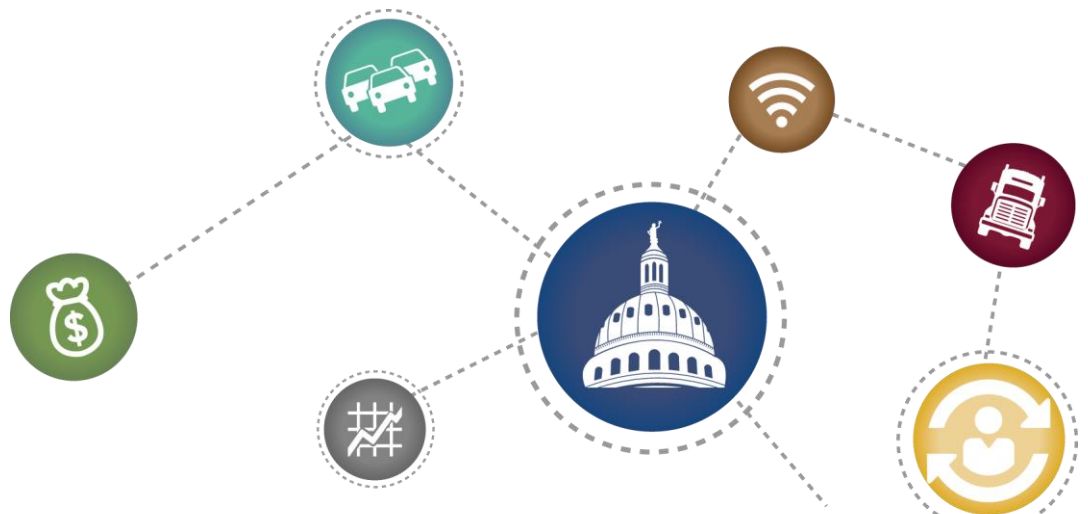


# Identifying Transportation Solutions That Promote Healthy Aging for Texans

## *Final report*

PRC 17-83 F



# Identifying Transportation Solutions That Promote Healthy Aging for Texans

Texas A&M Transportation Institute

PRC 17-83 F

September 2017

## **Authors**

Ben Ettelman  
Maarit Moran  
James Cardenas  
Joan Hudson  
Aysha Minot  
Phil Lasley

Copies of this publication have been deposited with the Texas State Library in compliance with the  
State Depository Law, *Texas Government Code* §441.101-106.

# Transportation Solutions That Promote Healthy Aging for Texans

---

As the number of older adults in Texas steadily grows, transportation remains essential to that population segment. This report presents an overview of how mobility impacts healthy aging and also reviews policies and programs that address the transportation-related needs of older adults:

- Mobility limitations, due in part to distance from services and financial barriers, can make it difficult to satisfy basic daily needs and can also lead to isolation, affecting both mental and physical health. Even with access to personal transportation options, however, safety is a primary concern for aging adults, as crash rates for older drivers are disproportionately higher.
- Under U.S. law, the Federal Transit Administration is authorized to allocate funds to provide services specifically for aging Americans and people with disabilities. Other programs, the Americans with Disabilities Act (ADA), Medicare and Medicaid, and the Older Americans Act also are designed to meet the special mobility needs of these groups.
- As adults age, they tend to drive less and many will stop driving altogether. Whether cessation is voluntary or not, readily available and easily accessible alternative transportation options are needed for aging people to maintain mobility. Driver license restrictions and training programs may be used to address safety concerns for this segment of the driving population.
- Public transit can be an especially important option for aging people who have no access to a vehicle, and those who either cannot or choose to not drive any longer; so access to public transit can help older adults remain active and independent later in life.
- Paratransit provides demand-based transportation service to the disabled and those who cannot access fixed-route public transit services. The high cost of this service typically limits it to those who meet ADA eligibility requirements, excluding a large segment of the aging population.
- Non-emergency medical transportation is a service available to Medicaid recipients, filling a gap for low-income Americans, including older adults. To qualify, persons must demonstrate that they do not have the means to travel to medical appointments or access other health services.
- Various ride services are available for older adults who are unable to drive and do not have access to transit, paratransit, or non-emergency transportation. These services include volunteer driver programs, for-hire services, and dispatcher programs.

- Active transportation—walking and biking—offers a healthy, safe, low-cost mobility option for older adults. However, these options are limited by both the environment (street design, availability of sidewalks, lighting, etc.) in some communities and the physical limitations of older adults.
- The older segment of the population in Texas is expected to almost double from 2010 to 2040. By that time, demographers project that one in five Texas will be more than 65 years old.
- Growing numbers of older adults are choosing to remain in their current homes for the rest of their lives; this aging in place is made more difficult by the transportation challenges this population segment faces. Various programs and technology applications (made more available by smartphones and the Internet) are helping to address these challenges and improve transportation access.
- Policies designed to improve existing transportation programs and services for all segments of the aging population will be a key factor in the promotion of healthy aging for senior Texans.

## Table of Contents

|                                                                                                  |           |
|--------------------------------------------------------------------------------------------------|-----------|
| <b>Transportation Solutions That Promote Healthy Aging for Texans .....</b>                      | <b>3</b>  |
| <b>List of Figures.....</b>                                                                      | <b>8</b>  |
| <b>List of Tables .....</b>                                                                      | <b>8</b>  |
| <b>Chapter 1: Introduction .....</b>                                                             | <b>9</b>  |
| Background .....                                                                                 | 9         |
| Report Overview .....                                                                            | 10        |
| Chapter 2: Overarching Themes Related to Promoting Healthy Aging among Older Adults .....        | 10        |
| Chapter 3: Federal Legal Framework to Support Healthy Aging for Older Adults .....               | 11        |
| Chapter 4: Transportation Solutions for the Aging Population.....                                | 11        |
| Chapter 5: Area Agencies on Aging .....                                                          | 11        |
| Chapter 6: Demographic Analysis of Aging Texans .....                                            | 11        |
| Chapter 7: Future Trends for Healthy Aging .....                                                 | 11        |
| Chapter 8: Final Takeaways .....                                                                 | 11        |
| <b>Chapter 2: Overarching Themes Related to Promoting Healthy Aging among Older Adults .....</b> | <b>12</b> |
| Safety: A Top Concern but Not the Only Concern for Older Adults.....                             | 12        |
| Mobility: Understanding the Unique Transportation Needs for Older Adults.....                    | 12        |
| Health: Transportation Can Support Healthy Aging and Improve Quality of Life .....               | 13        |
| Geography: Geographic and Built-Environment Factors Shape Travel Choices .....                   | 13        |
| <b>Chapter 3: Federal Legal Framework to Support Healthy Aging for Older Adults.....</b>         | <b>15</b> |
| Federal Transit Administration .....                                                             | 15        |
| Enhanced Mobility of Seniors and Individuals with Disabilities—49 U.S.C. 53 Section 5310 .....   | 15        |
| Texas Grant Funding .....                                                                        | 15        |
| Improving Services for the Transportation Disadvantaged.....                                     | 15        |
| Americans with Disabilities Act.....                                                             | 16        |
| Medicaid and Medicare .....                                                                      | 16        |
| Older Americans Act.....                                                                         | 16        |
| <b>Chapter 4: Transportation Solutions for Healthy Aging .....</b>                               | <b>17</b> |
| Driving and the Aging Population .....                                                           | 17        |
| Issues Associated with the Aging Population and Driving .....                                    | 18        |
| Programs and Policies for the Aging Population and Driving .....                                 | 20        |
| Public Transit and the Aging Population .....                                                    | 21        |
| Public Transportation in Texas .....                                                             | 22        |
| Issues Associated with the Aging Population and Public Transportation .....                      | 24        |
| Programs for the Aging Population and Public Transit .....                                       | 25        |
| Key Findings for the Aging Population and Public Transit .....                                   | 27        |
| Paratransit and the Aging Population.....                                                        | 28        |
| Paratransit in Texas.....                                                                        | 29        |
| Issues Associated with the Aging Population and Paratransit .....                                | 29        |
| Programs and Policies for the Aging Population and Paratransit .....                             | 30        |
| Key Findings for the Aging Population and Paratransit .....                                      | 31        |
| Nonemergency Medical Transportation and the Aging Population.....                                | 32        |
| NEMT in Texas .....                                                                              | 33        |

|                                                                                                          |           |
|----------------------------------------------------------------------------------------------------------|-----------|
| Key Findings for the Aging Population and NEMT .....                                                     | 34        |
| Ride Services and the Aging Population.....                                                              | 35        |
| Volunteer Driver Programs.....                                                                           | 35        |
| For-Hire Ride Services .....                                                                             | 37        |
| Dispatcher Programs.....                                                                                 | 39        |
| Key Findings for the Aging Population and Ride Services .....                                            | 40        |
| Active Transportation and the Aging Population.....                                                      | 41        |
| Issues Associated with the Aging Population and Active Transportation .....                              | 41        |
| Programs for the Aging Population and Active Transportation.....                                         | 44        |
| Key Findings for Active Transportation and the Aging Population .....                                    | 45        |
| <b>Chapter 5: Area Agencies on Aging.....</b>                                                            | <b>46</b> |
| Background .....                                                                                         | 46        |
| AAAs in Texas .....                                                                                      | 47        |
| Panhandle AAA.....                                                                                       | 50        |
| Dallas Area Agency on Aging .....                                                                        | 50        |
| Bexar Area Agency on Aging.....                                                                          | 50        |
| Key Findings for AAAs and Transportation for the Aging Population .....                                  | 51        |
| <b>Chapter 6: Demographic Analysis of Aging Texans.....</b>                                              | <b>53</b> |
| The Aging Population in Texas.....                                                                       | 53        |
| Key Demographic Findings for the Aging Population in Texas .....                                         | 54        |
| Mobility Need Index for Aging Population in Texas.....                                                   | 55        |
| Key Findings of Demographic Analysis of Aging Texans .....                                               | 57        |
| <b>Chapter 7: Future Trends for Healthy Aging.....</b>                                                   | <b>58</b> |
| Programs to Promote Aging in Place for Older Adults.....                                                 | 58        |
| Naturally Occurring Retirement Communities .....                                                         | 59        |
| Senior Pedestrian Focus Areas (New York, New York).....                                                  | 59        |
| Technology to Support Healthy Aging for Older Adults .....                                               | 60        |
| Transportation Network Companies .....                                                                   | 60        |
| Advanced Vehicle Technologies .....                                                                      | 60        |
| Online Shopping and Home Delivery Services .....                                                         | 62        |
| Key Findings about Future Trends.....                                                                    | 63        |
| <b>Chapter 8: Final Takeaways.....</b>                                                                   | <b>65</b> |
| Mobility Options for Seniors Will Need to Be Expanded .....                                              | 65        |
| Patchwork Approach to Providing Transportation Services to the Aging Population.....                     | 65        |
| Low-Income Aging Populations Need More Mobility Options.....                                             | 65        |
| More Research Is Needed to Understand the True Impact and Efficacy of Future Trends .....                | 65        |
| Opportunities for Agencies to Collaborate Could Lead to Increased Mobility for Aging<br>Population ..... | 66        |
| Urban and Rural Areas Will Both Face Mobility Challenges but Require Different<br>Solutions.....         | 66        |
| <b>References.....</b>                                                                                   | <b>68</b> |
| <b>Appendix.....</b>                                                                                     | <b>81</b> |



## List of Figures

---

|                                                                                                           |    |
|-----------------------------------------------------------------------------------------------------------|----|
| Figure 1. Proportion of Current and Projected Texas Population That Is 65 Years or Older, 2010–2050. .... | 9  |
| Figure 2. Map of Public Transit Services in Texas.....                                                    | 23 |
| Figure 3. Map of Texas Medical Transportation Program Regions. ....                                       | 34 |
| Figure 4. Countdown Pedestrian Signal.....                                                                | 43 |
| Figure 5. AAA Organizational Structure Summary. ....                                                      | 46 |
| Figure 6. 28 AAA Regions in Texas.....                                                                    | 48 |
| Figure 7. Dallas County Transportation Guidebook for Older Adults. ....                                   | 50 |
| Figure 8. 2015 and 2040 Projected Population over 65 in Texas. ....                                       | 53 |
| Figure 9. Proportion of Population over 65, 2015 and 2040. ....                                           | 54 |
| Figure 10. Results of Mobility Need Analysis.....                                                         | 57 |

## List of Tables

---

|                                                                                     |    |
|-------------------------------------------------------------------------------------|----|
| Table 1. Age-Related Impairments and Related Driving Problems. ....                 | 18 |
| Table 2. Proportion of Licensed Drivers by Age Group.....                           | 19 |
| Table 3. Texas Transit Agency Reduced Fares for Older Adults. ....                  | 26 |
| Table 4. AAA Budgets.....                                                           | 47 |
| Table 5. AAA Organizational Structure Summary.....                                  | 49 |
| Table 6. Characteristics for the MoNI. ....                                         | 55 |
| Table 7. Ownership of Computer and Mobile Devices in the United States in 2015..... | 63 |
| Table 8. Use of Internet by Age of Persons 65+ in the United States in 2013. ....   | 64 |



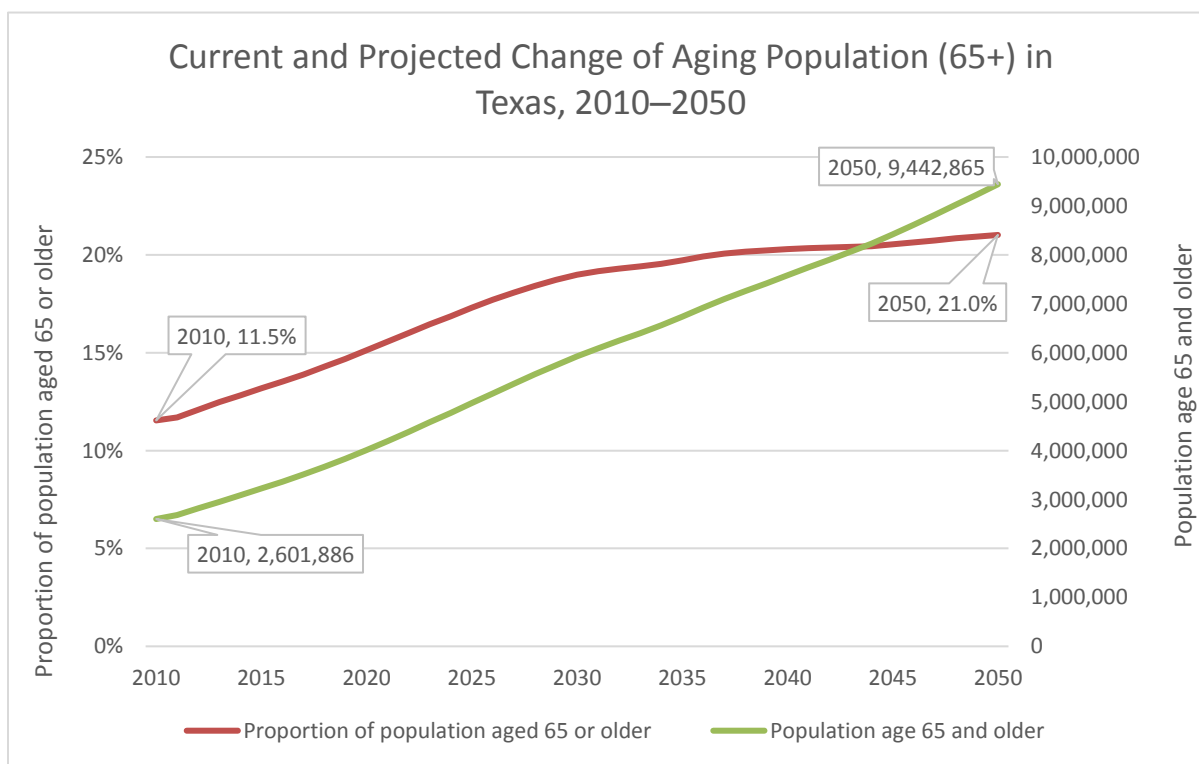
## Chapter 1: Introduction

As the population of Texans who are aging continues to grow, the role that transportation plays in the promotion of healthy aging is useful information for policy makers to plan and provide for the safe and healthy aging of Texas's population.

Transportation is a primary consideration to ensuring that Texas is well prepared to provide for the needs of the aging population. Not only does transportation ensure that this segment of the population has adequate access to necessary services and care, it is also an important component of ensuring independence and high quality of life for the aging population. This report provides an overview of how transportation impacts healthy aging and documents the policies and programs that promote healthy aging through transportation.

### Background

As the total population of Texas continues to increase, so does the number of older Texans. State demographers predict that the proportion of the Texas population that is age 65 years and older will continue to increase over the next 30 years (1). Figure 1 shows that given a similar pattern of in-migration that Texas experienced between 2000 and 2010, the proportion of the Texas population that is age 65 years and older will increase from 11.5 percent in 2010 to 21 percent in 2050.



Source: (2).

**Figure 1. Proportion of Current and Projected Texas Population That Is 65 Years or Older, 2010–2050.**

As this segment of the population grows, it is also important to consider that different age groups among older adults have different mobility needs. Gerontologists like to 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). With adults living longer, the unique nature of the mobility needs of each of these age groups is more distinct, and transportation solutions must be considered independently for each segment of the aging population.

The rapid growth of older adults, both in Texas and nationally, is expected to put a strain on existing programs that support the transportation needs of the aging population. This shift in demographics is largely due to the baby boomer generation (Americans born roughly between 1946 to 1964) transitioning from middle to old age (4). In 2017, the oldest baby boomers start turning 71, and the youngest will be 53 years old. Baby boomers will exhibit lifestyle patterns associated with aging that are distinct from previous generations since individuals are living longer and, as stated previously, the transportation needs of a 65-year-old are very different from those of an 85-year-old (5). In addition, this generation is interested in their ability to age in place. A 2015 survey conducted by the National Council on Aging found that 58 percent of adults 60 years and older have been in the same residence for more than 20 years, and 75 percent say they intend to stay in their current home for the rest of their lives. Moreover, the survey found that 42 percent of respondents indicated that a major concern was becoming a burden to others, and 34 percent of respondents indicated that not being able to get out of the house and/or drive was a major concern (4). The desire of this segment of the population to continue to be self-reliant as they age creates significant transportation challenges, including limitations in travel options associated with personal financial constraints. A 2015 study by the United States Government Accountability Office found that about half of households aged 55 and older do not have a retirement savings account. Lack of income and savings can reduce the ability of older adults to afford reliable transportation services that could otherwise increase their mobility options (6).

To address these challenges, this report further identifies the major issues regarding the transportation needs of older adults as well as the programs and policies that offer opportunities to provide the aging population with the ability to gracefully age in place.

## **Report Overview**

This report is organized into eight chapters, including this introduction (Chapter 1). The rest of the report is organized into the following chapters.

### ***Chapter 2: Overarching Themes Related to Promoting Healthy Aging among Older Adults***

This chapter introduces overarching themes identified in the literature that influence the transportation needs and healthy aging of older adults, including the following:

- Safety.
- Mobility.
- Health and Quality of Life.
- Geography.

### *Chapter 3: Federal Legal Framework to Support Healthy Aging for Older Adults*

The third chapter introduces the federal legal framework that funds programs and services that provide transportation for the aging population.

### *Chapter 4: Transportation Solutions for the Aging Population*

The fourth chapter discusses the universe of transportation modes and programs that serve the mobility needs of an aging population, including the primary issues associated with these transportation solutions, how these solutions are implemented in Texas, innovative approaches to providing these solutions to the aging population, and the strengths and weaknesses of each.

### *Chapter 5: Area Agencies on Aging*

The fifth chapter reviews area agencies on aging (AAAs) and the role these organizations play in connecting older adults to healthy aging and transportation services.

### *Chapter 6: Demographic Analysis of Aging Texans*

The sixth chapter presents a demographic analysis of the Texas aging population and an indicator of mobility needs across the state.

### *Chapter 7: Future Trends for Healthy Aging*

The seventh chapter discusses future trends that will influence the provision of transportation for older adults and support healthy aging.

### *Chapter 8: Final Takeaways*

The eighth chapter provides the final takeaways from this report.

## Chapter 2: Overarching Themes Related to Promoting Healthy Aging among Older Adults

---

A review of transportation and public health literature about the role of transportation in the promotion of healthy aging among older adults indicates that transportation is intricately linked to health and health services. When focused on how transportation can promote or present barriers to healthy aging, the following themes emerged from the review of current literature:

- Safety.
- Mobility.
- Health and quality of life.
- Geography and physical environment.

This chapter introduces and discusses these overarching themes as they relate to the travel needs of older adults. The following chapter considers these themes in the context of the different transportation modes that serve the needs of older adults.

### **Safety: A Top Concern but Not the Only Concern for Older Adults**

Safety is an important concern for older adults because older drivers have a disproportionately high number of crashes compared to their relative share of the population (7, 8). The National Highway Traffic Safety Administration (NHTSA) reported that in 2012, adults 65 years or older made up 17 percent of traffic fatalities and 20 percent of pedestrian fatalities nationwide, yet accounted for only 13 percent of the U.S. population. In addition, fatality rates increase as adults age; adults age 80–84 have the highest fatality rate among adults over 65 (9). Changes in visual, cognitive, and physical capabilities contribute to an increased risk of accidents and a reduced confidence while driving (8). These changes can create challenges for walking, biking, and accessing public transit services.

### **Mobility: Understanding the Unique Transportation Needs for Older Adults**

More recent literature suggests a shift in approach to the evaluation of the transportation needs of older adults that builds upon safety concerns to consider the more comprehensive need for mobility. The concept of mobility expands beyond simply having a car or access to a transit route and can be defined as “being able to travel where and when a person wants, being informed about travel options, knowing how to use them, being able to use them and having the means to pay for them” (10). This focus on mobility emphasizes that transportation provides not only access to transportation itself but access to social opportunities and health services.

Older adults who stop driving can experience a loss of independence. Even where alternative travel options exist, many older adults may not be familiar or comfortable with these options.

The physical or mental consequences of aging may make it difficult for older adults to walk, bike, or take transit to access activities. A lack of mobility can result in isolation and difficulty getting to necessary activities like grocery shopping and medical appointments (11, 12).

## **Health: Transportation Can Support Healthy Aging and Improve Quality of Life**

Physical health and mental health are important factors that contribute to healthy aging. A loss of independent mobility for older adults has been linked to depression, isolation, and reduced quality of life. Independent mobility provides self-reliance and control over one's life. For the aging population, the loss of mobility can lead to isolation that negatively affects both mental and physical wellbeing (13, 14). The American Association of Retired Persons (AARP) states that having access to and being part of a livable community is integral to the continued mental and physical health of older adults as they age. Livable communities include access to mobility options that facilitate personal independence and both civil and social engagement in existing and potential social networks (15, 16, 17).

## **Geography: Geographic and Built-Environment Factors Shape Travel Choices**

Physical geography and land use patterns impact the mobility options for older adults. The influence of these factors is particularly relevant given that most Americans do not move once they reach old age. Living in a physical environment that does not provide adequate mobility options may be a risk to healthy aging (18). In 2011, nearly half of adults aged 50 and over lived in suburban or exurban neighborhoods (19). Suburban neighborhoods are heavily reliant on automobiles for transportation, and often housing is located far from other amenities. This situation creates an environment where transportation options may be limited for older adults, and considerations for additional transportation services may be necessary, especially for those who do not or cannot drive. For example, non-drivers age 65 and older are more likely to stay home on a given day in rural areas (61 percent of older non-drivers) than those non-drivers in more dense, metropolitan areas (43 percent). In addition, one in three older non-drivers in dense areas will walk to a destination, while only one in 14 will do so in a spread-out area (20).

Rural areas typically have a higher proportion of older adults than urban areas throughout the United States (21). Two factors that impact mobility for older adults in rural settings are distance from services and financial barriers (22). Following is a description of each of these factors:

- *Distance from services*—Sprawling land development patterns, poor road conditions, and limited transportation alternatives can make it difficult for older adults to have reliable transportation (23, 24). It is difficult to provide public transportation that is cost efficient and effective in areas with lower densities and dispersed development. Many rural areas are served by public and private demand-response services, but many of these services are infrequent, inconvenient, and/or cost prohibitive for many older adults (23).

- *Financial barriers*—Financial barriers can contribute to a lack of access to transportation that in turn increases isolation and poor health among older adults. Rural adults age 60–64 are more likely than metropolitan older adults to be poor; after age 85, the percentage increases (21). In addition, rural older adults living in poverty are less likely to have access to a car (22). Older adults who lack transportation have a decreased ability to participate in the local community and economy. Lack of transportation for older adults can also exacerbate health problems because they are unable to access medical care (22).

## Chapter 3: Federal Legal Framework to Support Healthy Aging for Older Adults

---

This chapter provides an overview of federal policies that directly guide and/or fund transportation services for the aging population. While older adults use transportation services and modes that are also designed and provided for the general public, this chapter focuses narrowly on policies created specifically to meet the transportation needs of older adults. Many of the policies covered in this chapter support transportation services and programs discussed in Chapters 4 and 5.

### Federal Transit Administration

As discussed previously, older adults in the United States and Texas often rely on public transportation. The Federal Transit Administration (FTA) funds and supports public transit service across the United States. Under the U.S. Code, Section 5310 authorizes the only FTA funding allocated specifically for the aging population, which is a grant-based program aimed to provide transportation for older adults and people with disabilities.

#### *Enhanced Mobility of Seniors and Individuals with Disabilities—49 U.S.C. 53 Section 5310*

FTA is authorized by law to allocate funds under 49 U.S.C. 53 Section 5310, Enhanced Mobility for Seniors and Individuals with Disabilities, to assist “private nonprofit groups in meeting the transportation needs of older adults and people with disabilities when the transportation service provided is unavailable, insufficient, or inappropriate to meeting these needs” (25). Examples of programs funded by Section 5310 grants are discussed in Chapter 4.

#### *Texas Grant Funding*

In 2016, Texas received a total of approximately \$18.5 million for Section 5310 funding. The grant money is allocated by formula directly to recipients. In Texas, direct recipients are metropolitan transit authorities (e.g., Capital Metro, Dallas Area Rapid Transit [DART]) and the Texas Department of Transportation (TxDOT). These transit agencies and TxDOT then can allocate funds to subrecipients, such as rural or small urban transit agencies or specialized transportation providers, for programs or services that serve older adults or individuals with disabilities.

#### *Improving Services for the Transportation Disadvantaged*

In 2015, the federal transportation funding authorization bill, the Fixing America’s Surface Transportation Act, created a pilot program to fund innovative projects and improve coordination of services for the transportation disadvantaged (e.g., older adults, individuals with disabilities). The pilot program allocated \$2 million for 2016 and \$3 million in 2017 to be distributed among all 50 states (26).

## **Americans with Disabilities Act**

The Americans with Disabilities Act (ADA) of 1990 ensures that individuals with disabilities are granted equal opportunity and access to “employment, state and local government services, public accommodations, commercial facilities and transportation” (27). The ADA sets operational and vehicle requirements for most forms of public and private fixed-route transit, complementary paratransit, demand-responsive service, and rail systems (28). Many older adults rely on services required by the ADA, such as paratransit (discussed in Chapter 4).

## **Medicaid and Medicare**

In 1935, Congress passed the Social Security Act to ensure that Americans over 65 years old had continuing income and to address care for older adults. In 1965, the Medicaid and Medicare programs were authorized under the act. Medicare was instituted specifically to provide health care coverage for Americans over 65 years old but does not provide assistance directly for transportation costs other than in emergencies. Medicaid was instituted to provide health coverage for low-income Americans, including older adults, and can be applied to additional transportation costs.

Medicaid is jointly funded by the federal and state governments (29). States that distribute Medicaid are required to ensure that Medicaid recipients have adequate transportation to and from necessary providers. This is typically referred to as nonemergency medical transportation (NEMT). In Texas, NEMT is coordinated through the Texas Department of Health and Human Services Medical Transportation Program, which is discussed in Chapter 4.

## **Older Americans Act**

The Older Americans Act (OAA) was passed in 1965 to address lawmakers’ concern with the lack of community-based social services for the aging population. The law established the Administration on Aging to administer grants and programs that provide a range of social services to help adults over age 60 live independently, including transportation services. The programs funded through the OAA are implemented through a national network of organizations, including state and local AAAs. Local AAAs are community-based entities that plan, develop, coordinate, and deliver a range of community-based services. Transportation is one of the many services for older adults that is funded through AAAs (30). AAAs are discussed in more detail in Chapter 5.



## Chapter 4: Transportation Solutions for Healthy Aging

---

Many services and programs exist that offer transportation solutions for the aging population. These services and programs include efforts that range from assisting older adults with maintaining their independent mobility to providing older adults with direct transportation when they can no longer accommodate their own mobility needs. Research conducted for this report also revealed that the manner in which transportation programs and services are organized and administered to the aging population is highly disaggregated. For example, organizations such as AAAs administer and coordinate transportation programs and services for older adults, but not all AAA programs and services are administered or funded in the same manner from one community to the next. Many of the examples in this chapter illustrate that there is no standard approach that communities and regions follow to meet the transportation needs of the aging population. In contrast, the aging population relies on a multitude of services that are administered by a wide array of organizations and agencies.

This chapter summarizes transportation programs that are part of the universe of transportation services available to meet the needs of the aging population. For each transportation option, the context, availability, and specific issues for older adults are discussed. Examples of programs to better meet the transportation needs of older adults are also provided, with a focus on services in Texas (if available). Each type of service is evaluated for its key strengths and weaknesses in serving the aging population.

### Driving and the Aging Population

Driving is the primary mode of travel for all adults in the United States, including the aging population. The ability to drive one's self not only provides mobility but also offers individuals the freedom to manage their own schedule; go to work, school, or volunteer obligations; access medical services; and participate in social activities. However, the physical and mental consequences of aging can make driving uncomfortable, unsafe, or impossible for some older adults. This loss of mobility can reduce aging adults' participation in everyday activities and can have negative health and quality-of-life consequences (12, 23). Research suggests that future generations of older adults will continue to drive later in life in comparison to previous generations (7, 31).

The following subsections:

- Discuss issues identified in the literature review related to driving among the aging population.
- Provide examples of programs that help older adults safely operate automobiles later in life.
- Discuss key findings on the aging population and driving.

## *Issues Associated with the Aging Population and Driving*

The following is an overview of some of the issues that impact the aging population's ability to drive automobiles.

### *Older Adult Driving and Safety*

Safety on roadways is a concern for adults as they age. The risk of being involved in a crash increases significantly for adults over the age of 85 (8). Part of this increased risk stems from physical impairments that occur naturally during the aging process. A selection of age-related impairments and the driving problems associated with each are presented in Table 1. Various strategies and programs can help older drivers maintain their vehicular mobility.

**Table 1. Age-Related Impairments and Related Driving Problems.**

| <b>Age-Related Impairments</b>                                       | <b>Driving Problems</b>                                                                                                                                                       |
|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Increased reaction time, difficulty dividing attention between tasks | Difficulty driving in unfamiliar or congested areas                                                                                                                           |
| Deteriorating vision, particularly at night                          | Difficulty seeing pedestrians and other objects at night, difficulty reading signs                                                                                            |
| Difficulty judging speed and distance                                | Failure to perceive conflicting vehicles, crashes at intersections/junctions                                                                                                  |
| Difficulty perceiving and analyzing situations                       | Failure to comply with yield signs, traffic signals, and rail crossings; slow to recognize hazards; difficulty in complex traffic maneuvers such as lane changing and merging |
| Difficulty turning head/neck, reduced peripheral vision              | Failure to notice obstacles while maneuvering/reversing, lane excursion, difficulty merging and changing lanes                                                                |
| More prone to fatigue                                                | Getting tired on long journeys                                                                                                                                                |
| General effects of aging                                             | Concerns over inability to cope with a breakdown and difficulty driving to unfamiliar places, at night, or in heavy traffic                                                   |
| Impairments that vary in severity from day to day, such as tiredness | Concern over fitness to drive                                                                                                                                                 |

Source: (15).

The Federal Highway Administration (FHWA) published the *Handbook for Designing Roadways for the Aging Population*, which provides a set of roadway design elements empirically shown to better serve older adults (32). The recommended design treatments include specific applications in the following five categories:

- Intersections.
- Interchanges.

- Roadway segments.
- Construction/work zones.
- Highway-rail grade crossings.

The handbook provides specific and practical information that supplements existing standards and guidelines for highway geometry, operations, and traffic control devices (32). As the aging population grows, expanding the implementation of these supplemental design considerations may improve road safety for both aging drivers and all other road users.

### ***Driving Cessation***

As adults age, they tend to drive less, and many lifelong drivers will cease driving at some point. Driving cessation refers to an individual's voluntary or involuntary decision to stop driving (8, 31). Voluntary driving cessation typically occurs in older adults when they no longer feel safe operating a vehicle on their own. A lack of confidence in their ability to safely navigate their vehicle increases the risk of having an accident because fear and lack of confidence increases indecision and slows reaction time (8). While many young-old adults drive, the proportion of licensed drivers declines sharply between ages 70 and 80, as shown in Table 2 (33).

**Table 2. Proportion of Licensed Drivers by Age Group.**

| <b>Age Group</b>                                   | <b>Number of Drivers</b> | <b>Drivers as Percent of Age Group*</b> |
|----------------------------------------------------|--------------------------|-----------------------------------------|
| 55–59                                              | 20,068,052               | 92%                                     |
| 60–64                                              | 17,647,170               | 93%                                     |
| 65–69                                              | 14,788,404               | 92%                                     |
| 70–74                                              | 10,232,234               | 89%                                     |
| 75–79                                              | 6,833,757                | 84%                                     |
| 80–84                                              | 4,521,433                | 78%                                     |
| 85 and older                                       | 3,716,131                | 70%                                     |
| <b>TOTAL (all age groups, including not shown)</b> | <b>218,084,465</b>       | <b>84%</b>                              |

\*These percentages are computed using population estimates of the Census Bureau.

Source: (33).

Some older adults are forced involuntarily to cease driving after losing the mental or physical ability to safely operate a vehicle (8). Medical and vision issues make it more difficult, if not impossible, for older adults to drive. Issues include the loss of the ability to turn one's neck and the diminishing ability to correctly judge the speed of another car (34). Typically, women are more likely than men to stop driving voluntarily (35). Whether driving cessation is voluntary or involuntary, readily available and easily accessible alternative transportation options are necessary to maintain mobility for the aging population. Furthermore, if alternatives to driving

are readily available, older adults may choose to voluntarily stop driving before they are forced to, which may reduce accidents involving aging drivers.

### *Programs and Policies for the Aging Population and Driving*

The following provides policies and programs that address the aging population and driving.

#### ***Driver's License Restrictions***

One policy that is used to address safety concerns with older drivers is a state restriction on driver's license renewals for older adults. License restrictions may require older adults to renew their licenses at a certain age or at increased frequency, based on the assumption that older drivers are more likely to be unfit or unsafe drivers. At least two states (Illinois and New Hampshire) require all drivers 75 and older to complete an on-road test at renewal (36). Under the Texas Transportation Code, Sections 521.274 and 521.2711, adults over age 79 must renew their license in person, and licenses expire after 6 years. Individuals are also required to take a vision test. After age 85, a license will expire every 2 years and must be renewed in person (37).

However, research suggests that age alone may be a poor indicator of unsafe driving. A 2013 review of legislation on driver licensing policies found no evidence that general age-based license renewal requirements improved the safety of drivers, though some specific policies such as in-person renewal and driving restrictions may have possible safety benefits. Meanwhile, the negative consequences of prematurely stopping an older adult from driving can have negative mobility and health consequences for older adults (38). Policies on the use and design of driver's license regulations can aim to achieve a balance between ensuring the safety of road users and maximizing mobility for the aging population.

#### ***Driver Training Programs***

A range of training and educational programs exist to assist older adults in maintaining and improving their driving ability so they can continue to drive themselves for as long as safely possible. The following examples include a range of training programs.

##### **American Automobile Association Roadwise Driver™**

Roadwise Driver™ is a driver improvement course that helps reteach driving safety techniques to older adults. The program also provides training to older adults on new vehicle technologies that improve safety for older drivers (some of these technologies are described in Chapter 7). The course focuses on issues that adults deal with as they age, such as drowsiness, low visibility, and slower reaction times. Classes can be taken online or in a classroom with a live instructor (39).

##### **Car Fit—Vehicle Safety Education Program (Nationwide)**

CarFit is a free program designed to increase safety for older adults by providing education and training focused on 12 key areas related to drivers' fit to their personal vehicle. Training highlights features of each vehicle that can contribute to safety and comfort, including the following: proper adjustment of mirrors, a clear line of sight over the steering wheel, and plenty of room between the driver's breastbone and the air bag. The idea is that drivers who safely fit in

their car are better able to deal with stressful driving conditions. The program was developed by the American Automobile Association, AARP, and the American Occupational Therapy Association. Trained specialists are employed by TxDOT and offer car checks (40).

#### **Mature Driver Program (Baylor Scott & White Medical Center)**

An example of an application of the above training programs is the Mature Driver Program at Baylor Scott & White Hillcrest Medical Center in Waco, Texas. The educational program offers “educational opportunities to help educate drivers and make them aware of potential hazards.” The program implements the training programs developed by the American Automobile Association’s Roadwise Driver and the CarFit program using funding from TxDOT (41).

#### ***Key Findings for the Aging Population and Driving***

While driving can be more dangerous for older adults, maintaining independent mobility has significant benefits that promote healthy aging. Driver education programs are extremely useful approaches to enable older adults to continue to be able to safely operate automobiles and continue to live relatively autonomous lives. The key is to ensure that these programs are accessible to as wide a range of older adults as possible. This process includes increasing awareness of these programs and prioritizing funding for these programs so that there are minimal barriers to access for all aging adults. However, there are safety concerns associated with providing opportunities for older adults to continue to operate automobiles later in life. Policies such as driver’s license restrictions that act as fail-safes to ensure that older adults who lose their ability to safely operate automobiles are identified and removed from the road are a critical counterbalance to programs that keep older adults on the road longer.

Technology will also play a role in how older adults continue to safely operate automobiles later in life. Examples of new technologies, such as vehicle automation and smartphone applications, are discussed in later chapters.

## **Public Transit and the Aging Population**

Public transportation agencies provide rail, bus, and other travel options across Texas. Public transit is a travel option for older adults who cannot drive, have stopped driving, do not have access to a vehicle, or choose not to drive. Studies have shown that older adults will need access to public transportation for 7–10 years after they no longer drive (42). Public transit is a transportation mode that can help older adults stay active and independent longer during their senior years.

The following subsections:

- Detail how public transit is provided in Texas.
- Provide an overview of the issues identified in the literature review associated with the aging population and public transportation.

- Provide a summary of programs and policies that support public transit use by older adults.
- Discuss the key findings on public transit and the aging population.

### *Public Transportation in Texas*

Public transit services are available for anyone within an agency's designated service area. Densely populated areas typically have higher service levels than less populated suburban or rural areas due in part to how funding is allocated and to lower marginal operating costs. All areas of Texas, whether urban or rural, are served by a designated transit district or provider. Route times and scheduling times vary by location and provider but typically focus resources on weekday commuter peak travel periods.

### *Funding*

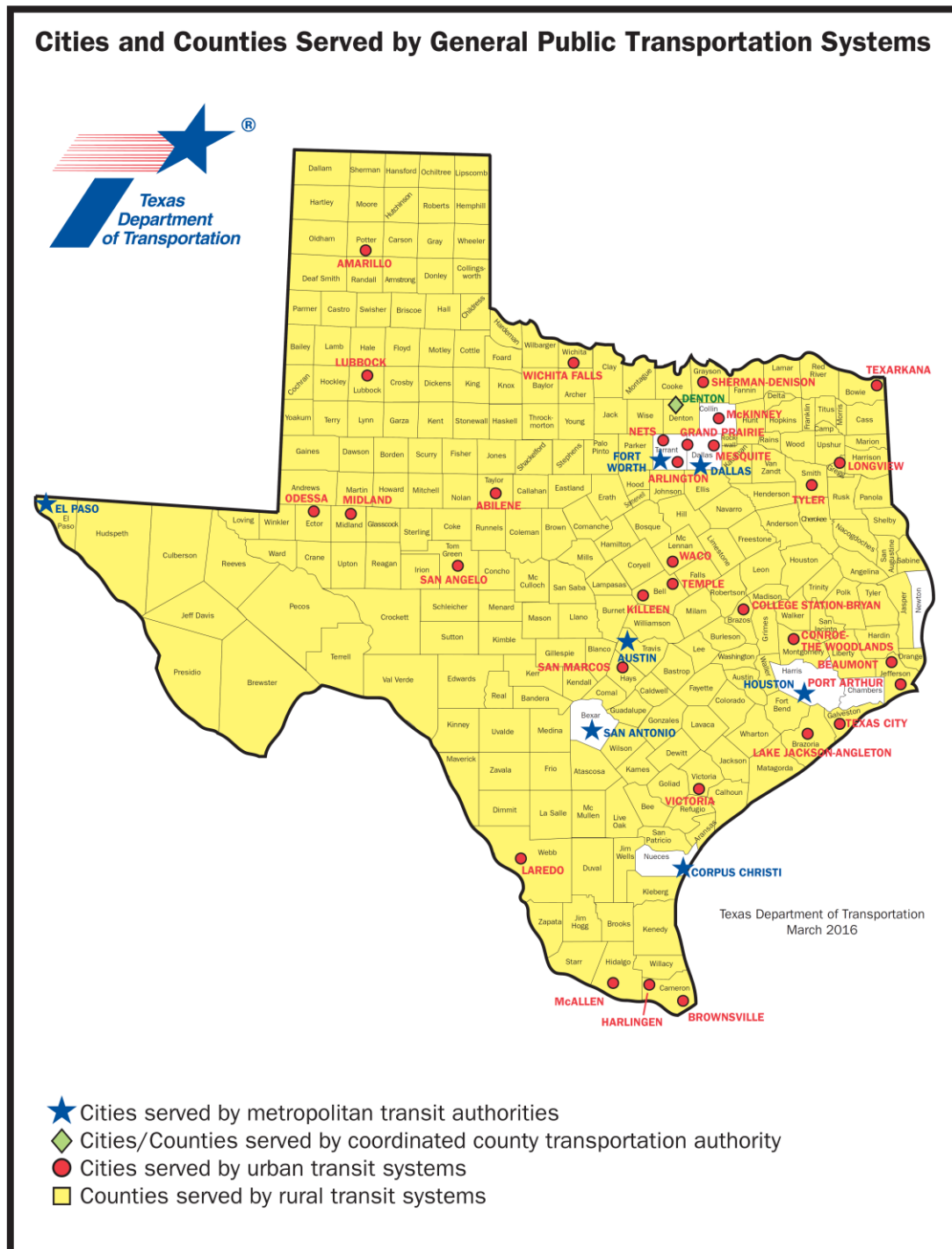
Texas transit agencies are financed by a combination of federal, state, and local funds. At the federal level, Congress authorizes an appropriation for public transit on an annual basis. The largest federal grants are separated into urbanized area and non-urbanized area grants. FTA allocates the funding based on a formula using the latest decennial census population numbers. (43). Other federal grants are available for specific purposes and uses, such as capital purchases and special purposes. For example, Section 5311 Enhanced Mobility of Seniors and Individuals with Disabilities grants are specifically for improving the transportation services that target older adults and individuals with disabilities.

TxDOT administers state transit funds to small urban and rural transportation districts. The Texas State Legislature appropriates state funds on a biennium basis. For the FY 2016–2017 biennium, the legislature appropriated approximately \$54.5 million. TxDOT allocates funds using a formula based on need and performance. State revenue, along with federal revenue, is the major source of revenue for rural and small urban transit systems. For larger transit authorities, local sources of revenue play a significant role. In Texas, transit authorities with approved sales taxes can draw a maximum of 1 percent sales tax. In 2017, nine transit authorities have approved sales taxes between 0.25 and 1 percent, which comprise the majority of revenue for these transit agencies. Other local revenue sources for transit districts and agencies include fare revenue, contract revenue, and other local contributions such as funds allocated, for example, from a municipal budget (44).

### *Public Transportation in Texas*

Public transit services are available throughout all parts of Texas. Public transit systems are regulated by federal law and by the State of Texas's Transportation Code (Title 6, Subtitle K, Chapters 451–460). The code gives authority to major metropolitan areas to establish transit authorities. TxDOT oversees and works with the remaining smaller urban and rural public transit providers by assisting with funding distributions and planning.

Figure 2 shows a map of counties in Texas served by rural transit agencies, urban transit agencies, and transit authorities serving metropolitan areas.



**Figure 2. Map of Public Transit Services in Texas.**

Generally, transit services in larger metropolitan areas will have fixed-route bus services coupled with paratransit services, commuter bus services, and fixed rail transit. Smaller urban areas will



typically have fixed-route bus service, paratransit service, and general demand-response or flex-route transit services. In rural transit districts, general demand-response services are typically used, sometimes complementing a small fixed-route system.

### *Issues Associated with the Aging Population and Public Transportation*

The following is an overview of some of the issues that impact the aging population's ability to use public transportation.

#### ***Public Transit Service Levels***

Transit service levels vary within each operating area. According to the *Transit Capacity and Quality of Service Manual, Third Edition*, service quality can be measured in terms of trip frequency, service span, and access. Other measures such as passenger load, reliability, and travel time contribute to the rider comfort and convenience of the service (45).

One example of varying levels of service is the difference between general demand-response service and fixed-route bus service. General demand-response service must typically be scheduled as much as 24 to 48 hours in advance. This differs in comparison to a fixed-route bus service, which may run every 30 minutes. While both services provide public transit to individuals, each has characteristics that distinguish different levels of service.

For older adults living in rural areas, demand-response service may be the only available public transportation option. Even for older adults living within a fixed-route bus system, a bus stop must be easily accessible for them to use the system. Last, costs also play a significant role in mobility. While some transit districts may offer discounted fares for older adults, the fare price for a demand-response service is generally higher than that of a fixed-route bus.

#### ***Trip Type***

As their lifestyles change, older adults travel for activities that differ from younger adults' reasons for travel; for example, they work less or are retired. Existing transit service may not meet the needs of older adults since many older adults are less likely to require trips that fit the schedules and design of public transportation (7). Retired adults typically make more trips to social activities, pharmacies, or grocery stores. These trip types make using transit challenging for aging adults. If public transit headways are infrequent, shorter trips like these may be inconvenient via transit. In addition, shopping trips require carrying bags, which also makes using transit difficult. Finally, older adults often make trips located within a few miles of their home, and these destinations are often too far to walk to but too close to conveniently take public transit (46).

#### ***Access to Transit Stations and Stops***

Accessible transit also requires key environmental features such as sidewalks, crosswalks, and proper wayfinding. Many Americans (especially baby boomers) live in areas with limited access to public transit (35). In Houston, Dallas, Fort Worth, and Austin, at least 50 percent of adults age 65–79 lack public transit within walking distance of their home (12).



While being within walking distance of public transit is an important factor for older adults, feeling as though they have *safe* access to transit is equally important. In a study conducted by the University of Vermont Transportation Research Center, rural and urban adults aged 55 and older rated safety as their first critical priority for livability (16). For many older adults, walking long distances alone and on unfamiliar roads to access transit stops feels unsafe. This feeling can lead many to stay home or default to using a car (12).

### ***Transit Stop Amenities***

In addition to access and safety, older adults require transit stop amenities such as seating at stops and protection from precipitation, sun, or heat. A study of older adults in the Houston area found that bus shelters were nonexistent in the majority (75 percent) of respondent neighborhoods (47).

### ***Programs for the Aging Population and Public Transit***

The following provides policies and programs that promote the aging population's use of public transit service.

### ***Special Public Transit Rates for Older Adults***

Federal law requires that all transit systems receiving federal funding are required to offer older adults, at a minimum, at least a 50 percent discount on peak-hour fares during off-peak hours. Little research has been done in the last 30 years to estimate the effect these programs have on ridership among older adults (48). However, many transit agencies incentivize transit for older adults with discounts that go beyond the minimum requirement. Agencies frequently expand the age of eligibility, offer a discount during peak hours, and discount the fares by more than 50 percent. Some transit agencies offer free transit service to older adults, including Southeastern Pennsylvania Transportation Authority in Philadelphia (49), Miami-Dade County (50), and all transit providers in Illinois (51).

Table 3 summarizes the current senior citizen discounts offered in major Texas cities. Notably, adults 70 or older can ride Houston METRO for free and adults over age 62 can ride San Antonio's VIA for free on weekends.

**Table 3. Texas Transit Agency Reduced Fares for Older Adults.**

| <b>City</b>    | <b>Transit System</b> | <b>Senior Fare/Pass Deal</b>                                                                                                                                                                     | <b>Age Eligibility</b> |
|----------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| Austin         | Capital Metro         | 50% discount on standard fares, day passes, and month passes                                                                                                                                     | 65+                    |
| Corpus Christi | The B                 | 66% discount during peak hours and on monthly passes and ~85% discount during off-peak hours on standard fares                                                                                   | 60+                    |
| El Paso        | Sun Metro             | 80% discount on standard fares (regular fare \$1.50, reduced fare \$0.30)                                                                                                                        | 65+                    |
| Dallas         | DART                  | 50% discount on local 2-hour, daily, and monthly passes; 70% discount on a regional annual pass                                                                                                  | 65+                    |
| Fort Worth     | The T                 | ~50% discount on standard fares and monthly passes                                                                                                                                               | 65+                    |
| Houston        | METRO                 | ~50% discount on all bus and light rail fares; free rides for adults age 70+                                                                                                                     | 65+, 70+               |
| Laredo         | El Metro              | ~75–85% discount on regular single fare (\$1.50) reduced to \$0.35 peak fare and \$0.25 off-peak fare                                                                                            | 62+                    |
| Lubbock        | Citibus               | 50% discount on standard fares and multiday passes                                                                                                                                               | 65+                    |
| San Antonio    | VIA                   | 50% discount on peak-period standard fares and multiday passes; off-peak special allows eligible older adults to ride bus service for free on weekends and \$0.25 from 9 a.m.–3 p.m. on weekdays | 62+                    |

Source: (52, 53, 54, 55, 56, 57, 58, 59).

Discounted transit fares for older adults may help overcome financial barriers to using transit. While most transit agencies provide discounts above the federally required minimums, there is no research to demonstrate how much of an impact these discounted rates have on the ridership of older adults.

### ***Transit Training Programs***

Transit training programs help older adults remain mobile by giving individuals the tools to safely and comfortably use transit services. Training programs can help address the safety concerns noted earlier. An example of a transit training program is Capital Metro’s Travel Training Program located in Austin, Texas.

Capital Metro’s Travel Training Program provides a variety of information for older adults and people with disabilities. The training is free and provides information on how to accomplish the following:

- Plan a trip.
- Travel to and from the bus stop.

- Board a bus and pay the fare.
- Use the ramp or lift.
- Identify landmarks.
- Transfer between buses.
- Ask the driver for assistance.
- Problem solve if unexpected situations are encountered while traveling in the community.

Riders can schedule a travel training appointment by emailing or calling a customer service line. Capital Metro staff will assist with individual, self-paced training until the rider feels confident about riding transit. Free day passes are also available to customers during lessons (60).

### *Key Findings for the Aging Population and Public Transit*

Public transit provides a viable transportation option for many older adults. Using transit can be a safer and healthier alternative to driving. However, issues such as availability, cost, reliability, and accessibility are challenges that can contribute to decreasing the accessibility of transit to older adults. While transit services exist across the state, many older adults do not live close to public transit services, particularly in suburban and rural areas where service is less robust or nonexistent.

Strengths of public transit service for older adults include:

- **Transportation Alternative:** Public transit can be a useful and cost-efficient alternative to driving. Overall, transit fares are highly subsidized and lower than most transportation options. Some transit agencies even offer reduced fares for older adults.
- **Accessibility Programs:** Programs such as travel training are available for older adults and people with disabilities. These programs can help older adults become familiar with how to ride transit and use a schedule. Overcoming such initial unknowns can lead to more efficient usage of transit services.
- **Healthy Lifestyle:** Walking to and from bus stops and destinations can help older adults stay active. Walking and exercise are important for all adults, including older adults. Using transit is one way to stay active while commuting to and from destinations.

Where public transit is available, challenges still exist. Weaknesses of public transit service for older adults include:

- **Transit Service Quality:** Transit quality depends on factors like frequency, service span, and reliability. Large variations in on-time performance can cause riders to seek other means of transportation if available. Different areas in Texas vary in quality due to differences in resources and environments.

- **Surrounding Built Environment:** The built environment includes sidewalks, crosswalks, and shade from trees or other structural shelters. A lack of these amenities may hamper access to older adults.
- **Transit Service Awareness:** Transit services in rural areas may not be well advertised. Misconceptions ranging from how to schedule a pick up to which transit service is available can often be a hindrance for older adults.
- **Transit Availability:** Transit availability may be limited by the transit provider as to where and when trips can be made. In larger urban areas, transit service availability can vary widely, depending on where an individual lives and where he or she wants to go. This can sometimes lead to inconveniences such as long walks to the bus stop and long commute times to and from a destination.

## Paratransit and the Aging Population

Paratransit is a supplementary service to fixed-route public transit that provides demand-response transportation service by public or private providers to those with disabilities who cannot access fixed-route public transit services (61). Transit providers are required by law to provide paratransit within a ¾-mile buffer of all fixed-route transit service. Some transit agencies expand paratransit service to older adults under some circumstances (e.g., older adults living in assisted living facilities) (34). Transit providers may operate paratransit directly or through partnerships between transit providers and private companies to provide paratransit services through demand-responsive services and accessible vehicles (18).

Paratransit is different from conventional public transit service because it is tailored to better serve the needs of individuals with disabilities or other special needs. There are three types of paratransit service:

- **Curb-to-curb:** The driver picks up and drops off at the curb of the location and only assists with boarding and exiting the vehicle.
- **Door-to-door:** Along with curb-to-curb service, the driver then assists the passenger to the entrance of the location.
- **Door-through-door:** Along with door-to-door service, the driver assists the passenger with exiting the pick-up location and entering the drop-off location (18).

Two systems are most commonly used by transit agencies to fulfill paratransit requirements: (a) organizing the ride with the passenger (dial-a-ride), or (b) offering a subsidy (user-side subsidy program) (18).

Dial-a-ride service requires users to call at least 24 hours in advance to schedule a ride. Like carpool, dial-a-ride requires the operator to coordinate trips with other passengers, and the driver

must pick up and drop off riders at the various coordinated locations. This service is most often provided by a wheelchair-accessible van (18).

User-side subsidy programs allow users to buy trip vouchers from the entity providing fixed-route transit to pay for paratransit trips. The vouchers can be used with any participating paratransit provider. The providers then use the vouchers to recover the cost of the trip from the transit agency. This is most often provided by taxicabs in the service area (18). Examples of user-side subsidies in Texas are provided in the following subsections, which:

- Detail how paratransit service is provided in Texas.
- Provide an overview of the issues identified in the literature review associated with paratransit and the aging population.
- Provide a summary of programs and policies that aid paratransit use by the aging population.
- Discuss the key findings for paratransit and the aging population.

### *Paratransit in Texas*

Paratransit service is required anywhere a federally funded entity offers fixed-route transit. Figure 2 in the previous subsection provides a map of all existing transit agencies offering fixed routes in Texas. For the urban and rural transit agencies that operate fixed-route transit services in Texas, paratransit service is provided using accessible van fleets. Private taxi companies are also used to supplement paratransit services. The rural transit agencies that do not operate fixed-route transit meet paratransit requirements with demand-responsive services that are available to all residents, regardless of ability. However, these demand-responsive services are not offered all days of the week since only eight transit providers throughout the state offer demand-responsive services on Sundays.

### *Issues Associated with the Aging Population and Paratransit*

The following is an overview of issues identified in the literature review associated with the aging population and paratransit's ability to support healthy aging.

#### ***Cost Ineffectiveness of Paratransit***

Paratransit is an expensive service, and high per-trip costs contribute to strict limitations by providers on who can use paratransit. These strict criteria exclude many older adults who may have mobility challenges but do not have a disability severe enough to qualify for paratransit (62). A 2012 United States Government Accountability Office report estimated that the average cost of an ADA paratransit trip was \$29.30, while the average cost of a fixed-route trip was \$8.15 (63, 64). For transit providers, a paratransit trip can cost more than three times the amount of a fixed-route trip. ADA regulations instruct that no transit agency can charge a paratransit user more than double the amount of a fixed-route trip. In 2015, the fare for one paratransit trip on Houston's METROLift was \$1.25, while the estimated cost for one round trip using a taxi

service was \$22.51, and the cost for a round trip on a small bus with wheelchair access was \$30.46 (64, 65, 66). While ADA regulation is intended to ensure that people 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. With limited capacity to provide service, paratransit trips are often late for pick-ups and drop-offs due to poor coordination and lack of staffing for trips (63, 65, 66).

### ***Not All Older Adults Are Eligible for Paratransit Services***

While some transit providers extend service to all senior citizens, the high cost of paratransit trips has caused most transit agencies to restrict paratransit services to riders who meet the minimum threshold required by ADA regulations. This eligibility is based on having a documented disability that completely prevents them from accessing a transit stop. This provision results in many older adults not being eligible for paratransit service. For many older adults, issues such as difficulty walking long distances or being in the sun for long periods of time could make it difficult to reach a transit stop but do not qualify them for paratransit. As older adults continue to age, the risk of injury from attempting to reach a bus stop may increase (31, 67).

### ***Programs and Policies for the Aging Population and Paratransit***

The following paragraphs discuss policies and programs that aid the aging population's use of paratransit service. As discussed above, agencies that are responsible for providing paratransit will offer alternative transportation services using a voucher system to reimburse drivers. Taxi subsidy programs allow older adults who cannot afford standard taxi prices to use vouchers to receive a reduced fare. Vouchers are normally used to take necessary trips to the grocery store and medical appointments. Demand for voucher programs is extremely high, which causes many subsidy providers to provide vouchers only to the highest need applicants (usually ADA-eligible riders) (15). There are several voucher programs in Texas; the following are examples of programs provided by Harris County and Houston METRO.

#### ***METROLift Subsidy Program***

METROLift Subsidy Program (MSP) offers same-day or last-minute service for METROLift-eligible passengers who cannot be accommodated by advanced reservation services offered through paratransit. MSP offers a voucher of up to \$8 per trip, and clients are expected to pay the first \$1 and any amount over \$9. MSP currently partners with Yellow Cab Co. and Fiesta Cab Co. in the Houston area. METROLift is not involved in trip scheduling; trips are arranged between the client and the partner service providers. The service is offered 24 hours a day, 7 days a week (68, 69).

METRO issues vouchers directly to taxicab companies, and METRO provides the taxicab companies with a list of METROLift certified clients monthly. Customers call the taxicab company and identify themselves as MSP eligible with a patron ID number. The taxicab company then verifies this number against the METROLift-provided list. Drivers are then

dispatched with a random voucher number generated by METRO that identifies the passenger with a photo ID at pick-up. The driver then fills out a blank form with the voucher number, and the customer must sign the form. The driver then takes the form to the taxi company to be reimbursed for the cost of the trip (68, 69).

### ***Harris County RIDES***

Harris County RIDES (previously known as Harris County Coordinated Transportation Program) offers discounted curb-to-curb shared ride and taxi service for people who are eligible. Eligibility for the program requires that applicants do not have access to METROLift paratransit service or have no other alternative for older adults. To qualify, adults must be 65+ or have a documented disability and reside in Harris County (70).

Approved customers can load money onto an electronic fare card that is distributed by RIDES or a sponsoring agency. The cost is based on the rate of the meter fare box, and customers are allowed up to \$48 for a one-way trip. Customers are expected to pay 50 percent of the trip cost. To request the service, a customer can call one of the participating transportation providers 24 hours a day, 7 days a week at least 90 minutes in advance. Wheelchair-accessible vehicles are available upon request (70).

### ***Key Findings for the Aging Population and Paratransit***

Paratransit has been and will continue to be a key aspect of how disabled members of the aging population receive transportation services, though the high cost of providing paratransit will likely continue to limit these services to those individuals who meet ADA eligibility requirements. This leaves a large segment of the aging population out of the equation. Many older adults have severe mobility challenges that prohibit their ability to access transit stops, yet those mobility challenges do not qualify them for paratransit service. Policies that seek to increase access to public transportation for the segment of the population that has limited mobility but is not disabled may increase the ability for older adults to stay mobile and independent later in life.

As technology continues to shape how people interact with transportation services, one emerging opportunity is for transportation network companies (TNCs) to improve the efficiency, and potentially the cost, of operating paratransit services. One example is Boston's Metropolitan Bay Transit Agency's (MBTA's) pilot partnership with TNCs to supplement traditional paratransit contractors. As of September 2016, MBTA's paratransit service (known as The Ride) has been using Uber and Lyft to reduce the cost of paratransit rides by replacing them with Uber or Lyft rides. Lyft allows users to request rides over the phone rather than through a phone application. The service provides door-to-door service to people with disabilities and older adults. The Ride paid around \$31 for each paratransit ride, though through the partnership with TNCs, the cost of a trip was as low as \$13. Users pay the first \$2 for each ride and pay any additional cost above the \$13. Replacing paratransit service with rides from TNCs can reduce the cost of providing



paratransit, and in many cases these services can offer better coordination to allow users to get to their destinations on time and with ease (71).

## **Nonemergency Medical Transportation and the Aging Population**

NEMT is a transportation service provided to recipients of Medicaid for medical appointments and visits to the pharmacy, urgent care, or the hospital for nonemergency situations. Initiated in the 1970s to ensure that Medicaid-eligible recipients have access to nearby medical facilities, NEMT fills a transportation gap for low-income Americans, including older adults (72). Besides being eligible for Medicaid, an individual must also qualify for NEMT services by demonstrating that he or she does not have a way to reach a medical appointment. The following considerations are examples of NEMT qualifications:

- Not having a valid driver's license.
- Not having a working vehicle available in the household.
- Being unable to travel or wait for services alone.
- Having a physical, cognitive, mental, or developmental limitation (73).

Often, the vehicles used to transport riders are capable of carrying wheelchairs, stretchers, or other special needs. Medicaid pays for the least costly and appropriate way to travel to appointments, whether by taxi, van, public transit, or mileage reimbursement. Recipients who provide their own transportation can receive travel reimbursement for costs such as gasoline, car maintenance, vehicle modifications, and other travel expenses. NEMT is essential for those patrons who are older or who have disabilities or low incomes and have no transportation to access healthcare services.

In 2014, the Texas Health and Human Services Commission (HHSC) implemented a statewide regional brokerage program, awarding contracts to seven brokers operating in 11 managed transportation organization (MTO) regions (see Figure 3) and the two service delivery areas (SDAs) of Houston and Dallas. A brokerage system is one in which the rider is connected with a transportation provider by a private company or state agency. The brokers confirm the Medicaid beneficiary's medical eligibility and then make sure the trip is to an approved Medicaid destination for a medical necessity. The brokers also confirm that the transportation provider is licensed and has passed safety inspections before contracting for services.

Of the MTOs, one is a transit agency, one is a health and human service agency, and the other five are national brokers and transportation companies. Texas operates the second largest NEMT behind New York (74).

To arrange NEMT, persons 60 or older call local AAAs, access transportation services through the Texas HHSC website, call 211, or go to the American Public Transportation Association website to find the Texas Transit Links.



The rates vary across the 11 regions and in Houston and the Dallas/Fort Worth (DFW) area. Generally, rural trip costs are higher than urban trip costs. For example, in Region 7 in Central Texas, the amounts paid monthly per qualifying individual in 2015 for transporting Medicaid adults were \$24.95 in rural areas and \$10.17 in urban areas (75).

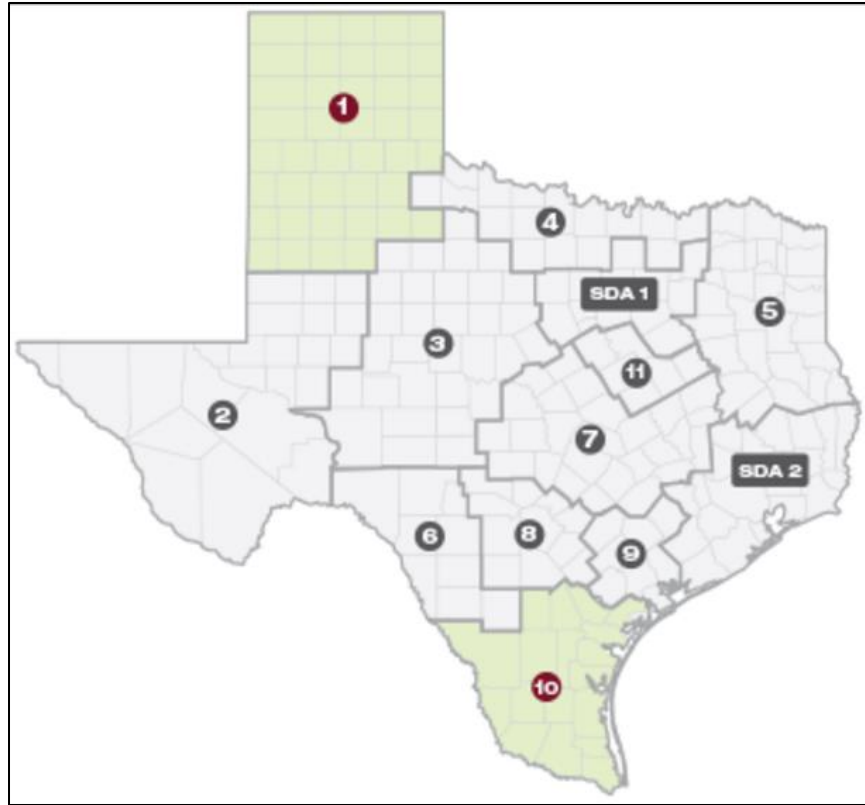
The next subsections offer an overview of how NEMT is provided in Texas and discuss key findings regarding the aging population and NEMT.

### *NEMT in Texas*

In West Texas (Region 2), Project Amistad was named by the Texas HHSC as the MTO. Serving 23 West Texas counties including El Paso and the Greater Midland-Odessa region, Project Amistad arranges cost-effective nonemergency medical transportation services to medically necessary health care services for eligible Medicaid clients (76). The organization determines if mass transit is the appropriate mode of transportation (client lives within ¼ mile from a public fixed-route stop). It offers a more flexible program that allows clients to ride with family members, friends, or others in a personal car to health care appointments. The individual transportation participant (ITP) enters into an agreement with Project Amistad and receives mileage reimbursement at the current state employee rate. As an ITP, the volunteer must have a valid driver's license, vehicle insurance, vehicle inspection, and vehicle registration. Out-of-town and out-of-state travel can be arranged by Project Amistad staff with advanced notice. In 2016, Project Amistad added five new, state-of-the-art, 15-passenger buses equipped with safety cameras, on-board computer technology, and wheelchair lifts. According to its 2016 Annual Report, Project Amistad's staff provided transportation to 266,210 persons through its MTO (77). From its main office in El Paso and another office in Midland, Project Amistad has been providing transportation and social services for over 40 years.

LeFleur Transportation is the MTO in the Texas Panhandle (Region 1) and South Texas (Region 10) (78). Figure 3 shows a map of the regions. It dispatches both contractors and its own employees to do the driving. It also educates consumers about the option of NEMT.

Transportation varies from city buses to on-demand service by passenger vehicle, or even air transportation if necessary (78). LeFleur will reimburse mileage if the client has a car or someone who can drive him or her. At LeFleur, routine appointments must be scheduled at least two business days in advance, and appointments outside of the county of residence must be scheduled at least five business days in advance (79).



Note: LeFleur is the MTO in the red-numbered/shaded regions.

Source: (79).

**Figure 3. Map of Texas Medical Transportation Program Regions.**

### *Key Findings for the Aging Population and NEMT*

NEMT fills a need in Texas for those people over the age of 60 who do not drive and need to reach medical appointments, the pharmacy, or the dentist. The idea of reimbursing family members and friends for providing travel removes some of the financial burden for these drivers.

Some shortcomings of NEMT in Texas are that it is only available for medical needs and for those with Medicaid. Someone who needs to go to the grocery store, post office, or shopping center will not be served by NEMT. Other potential issues are that unless a family member or friend provides transportation, travel may take much longer; there may be a wait for the ride/bus, there may be a wait for the appointment if one arrives too early, there may be a wait for the ride following the appointment, or the ride in the vehicle may be longer than desired due to others being picked up or dropped off. These delays mean that less time is available for other aspects of life.

Over the last several years, the NEMT program in Texas has undergone structural changes that may cause confusion for people who need this service and for those who care for them. Prior to 2011, the metropolitan transportation plan was delivered through a network of transportation service area providers that coordinated services in each of the 24 service areas. During that time, all medical transportation services were scheduled through a toll-free line that connected to four

service centers. Then in 2011, HHSC piloted a full-risk broker in two SDAs—Houston and Dallas. HHSC continued to be responsible for the services reimbursed on a fee-for-service (FFS) basis in the rest of the state. As stated above, this changed again in 2014 when the state implemented a statewide regional brokerage program. Because of these changes, it is difficult to stay informed on how to access these services, especially when websites are outdated and links no longer work.

In addition, a Legislative Budget Board report released in early 2017 found that since 2011, when the NEMT program was privatized, the number of Medicaid recipients who use the program has dropped from 350,000 to 150,000, causing the overall per-ride cost to the public to nearly triple. The Budget Board found that privatization eliminated thousands of people's access to NEMT services and cost taxpayers an estimated \$316 million more than it would have cost if the state were still running the program. The Texas HHSC is taking action to re-procure contracts with NEMT providers based on poor performance in an attempt to improve the efficiency of and access to the service (80).

## **Ride Services and the Aging Population**

For older adults who no longer drive, are not physically capable, or do not have direct access to public transit, paratransit or NEMT ride services are the primary mode of transportation. Ride services include volunteer driver programs, taxis, carpooling, and ridesharing. These options offer reliable, convenient, and comfortable door-to-door travel for the aging population. In many cases, these services will be provided by family or friends since research has found that older adults who do not drive often rely on family members or friends to transport them to necessary activities. Unfortunately, not all older adults have this option (25). Fortunately, for individuals who do not have the option of relying on family and friends, a range of ride services is available.

The following sections include information on a range of ride services, including:

- An overview of example volunteer driver programs in the United States and Texas.
- An overview of for-hire ride services, including taxi and TNC programs in the United States and Texas, that focus on senior transportation.
- An overview of dispatcher programs that organize rides for older adults through for-hire ride services.
- Key findings regarding ride services and the aging population.

### ***Volunteer Driver Programs***

Volunteer driver programs connect older adults with mobility needs to volunteer drivers. The programs vary widely in terms of organizational structure, funding sources, trips served, and the type of assistance they provide (e.g., door-through-door assistance, carrying packages). There are numerous examples of volunteer driver programs operating in Texas and across the United States. The National Volunteer Transportation Center, an organization dedicated to promoting

and supporting volunteer transportation, reports that the more than 700 volunteer driver programs in its database provide approximately 5 million trips per year in the United States. Although most of these programs are local and community-based, volunteer driver programs are also supported by federal funding, such as FTA funding, and by AAAs, hospitals, health providers, and other philanthropic or service organizations (81). For example, from 1983 to 2008, the Robert Wood Johnson Foundation supported the development of many volunteer driver programs through a nationwide program dedicated to supporting volunteer caregiving initiatives for older adults and others in need (82).

The following are examples of national and Texas-based volunteer driver programs that reflect the varying forms that these programs can take.

### ***ITN America (Nationwide)***

The Independent Transportation Network (ITN) of America is a nonprofit transportation model that utilizes a network of volunteer drivers to serve the transportation needs of older adults. Riders over the age of 60 can become a member with an affiliate ITN America organization in their local area. Rides are scheduled the day prior before 4 p.m. or on the same day for a higher fare. Drivers are volunteers who get reimbursed for part of the mileage driven. Drivers also accrue ITN America credits for future use, either by them or by a family member. ITN America operates in over 15 states, but currently no ITN America affiliates operate in Texas (83).

### ***Drive a Senior (Central Texas)***

The Drive a Senior network is a Central Texas initiative focused on providing riders to older adults who need transportation services. The service is provided at no cost to riders and is comprised of over 1,600 volunteer drivers. In 2013, the program provided more than 40,500 rides to 3,200 Central Texas senior citizens. Older adults aged 60 and over who are non-drivers or are limited drivers are eligible to use the program. Older adults must be able to walk on their own or with walkers or canes. Currently, the program contains no wheelchair-accessible vehicles (67).

### ***Faith in Action Georgetown (Georgetown, Texas)***

Providing older adults age 65 and older with transportation to medical appointments, beauty salons, shopping, banking, and other destinations, Faith in Action Georgetown (FIAG) provided over 6,000 rides in 2016 with the help of 215 volunteers. More than 75 percent of the rides are for health-related appointments or access to food. In 2017, FIAG received a \$120,000 grant from FTA that has allowed for extended operations for its more than 500 clients. Clients must be enrolled in the program and be ambulatory independently or with the assistance of a cane or walker. Wheelchairs are not allowed. Clients are also able to use their handyman services, access the medical equipment closet, and receive information and referrals (84).

### ***Senior Rides and More (Houston, Texas)***

In Houston, Senior Rides and More is another faith-based nonprofit that provides free rides to senior citizens who live in specific zip codes and are not in a wheelchair. Both care receivers and volunteers go through an application process that requires training, a background check, a current driver's license, and insurance. A supplemental insurance policy is provided by the organization as well. Volunteers use their own vehicles and gas to take older adults grocery shopping, to medical appointments, to food banks, or on other transportation-dependent errands. Senior Rides and More offers a small stipend to refund the cost of gas for the volunteers. To be eligible, adults must be 60 or older, ambulatory, not diagnosed with a mental illness, and not diagnosed with Alzheimer's. In addition to providing rides, volunteers also stay with the care receiver during the appointment, which creates an opportunity for companionship (85).

### ***For-Hire Ride Services***

For-hire ride services are predominantly offered through taxicab companies and TNCs. Both types of for-hire ride services have programs that aim to better serve the specific needs of the aging population. The following subsections offer a description of how taxicab companies and TNCs provide transportation for the aging population as well as specific examples of programs offered by these companies that are tailored to serve older adults.

### ***Taxicab Companies and the Aging Population***

Taxicabs are a for-hire ride service used by many older adults as they lose the ability to drive themselves or safely access amenities via active transportation or public transit. As discussed previously, many transit agencies offer vouchers for private taxi companies to provide rides to older adults in lieu of a paratransit shuttle (86). In addition, taxicabs are a widely available transportation option for older adults who do not have special needs and can afford the cost of the service. For this segment of the aging population, taxicabs represent a transportation option that provides independent mobility that can stretch late into life. For adults with physical limitations who do not qualify or do not otherwise have access to paratransit services, standard taxicabs may not provide suitable service. While many taxi companies have vehicles equipped to provide rides for individuals (including older adults) with physical limitations, the cost of these vehicles is high, and these rides may lower overall productivity for drivers. To incentivize taxi companies to have larger fleets of accessible vehicles, some cities have passed ordinances that require taxicab companies to increase the size of their accessible fleets. In addition, some taxi voucher or discount programs funded by local organizations, agencies, FTA grants, and AAAs are not limited to older adults with disabilities, which increases the accessibility of taxicabs to older adults who have physical limitations or who cannot afford standard taxi services (87).

The state of Nevada has a program that improves access to taxicab use by older adults with low income. The Nevada Department of Human Services' Aging and Disability Services Division provides the Taxi Assistance Program for Nevada residents 60 years and older who meet low-income eligibility requirements. Participants can purchase a limited number of discount coupons

that apply to rides with all taxicab companies operating in Clark County. This program does not apply in other Nevada counties (88).

Note that no examples of these types of programs were identified within Texas.

### ***TNCs and the Aging Population***

TNCs are a new entrant into the for-hire ride service industry that use new technologies to provide a streamlined taxi-like ride. TNCs such as Uber and Lyft are expanding upon their conventional service with service models and partnerships designed to better serve older adults. For example, Lyft Concierge is a program designed to allow senior care providers (e.g., nonprofit groups, senior care communities, and home care providers) to request rides on behalf of older adults (89). These alternatives may fill gaps in service, reduce reliance on family or volunteer drivers, and be tailored to the needs of older adults. However, currently there is very limited information about the success of such services at serving this population due to their relatively recent development. In addition, challenges regarding the aging population's use of smartphone technology may be a barrier to widespread adoption, particularly among the old-old population. Additional research is required to understand how these services will improve mobility for the aging population.

The following are examples of TNC service models that focus on providing the aging population with increased access to their services.

### ***UberACCESS Houston***

UberACCESS allows customers to use a smartphone application to order same-day ride service. Like Uber, UberACCESS is an on-demand ride service, but it is unique in that it offers the option for wheelchair-accessible vehicles. Customers can use UberACCESS by opening the standard Uber application and typing "access" in the promotional code section. Once the promotional code is entered, a new part of the application is accessed, allowing customers to request wheelchair-accessible vehicles. This application could be helpful for older adults who either use a wheelchair or require assistance to board and exit the vehicle. As of April 2016, Houston is the only city to offer UberACCESS in the state of Texas (90, 91).

### ***Liberty Mobility Now***

Liberty is a Nebraska-based TNC that seeks to operate in small urban and rural communities in partnership with government agencies and nonprofits that serve transportation-disadvantaged customers. Its goal is to coordinate with public transportation and other transportation service providers to better serve rural areas. The service is application based, similar to Uber, but is designed to work in areas with little or no cell signal. Currently, Liberty is working with the Coastal Bend Center for Independent Living in Corpus Christi to provide rides to older adults in partnership with Liberty. Coastal Bend is utilizing Section 5310 funding for its Mobility Options Program to offset the fare costs. Liberty is set to launch in Corpus Christi in July 2017 with a larger plan to be nationwide by 2020 (92, 93, 94).

### ***Lift Hero TNC (California)***

Lift Hero is a TNC that provides an Uber-like service aimed at older adults. Lift Hero's unique features include roundtrip availability, phone-based ride booking, and specially trained drivers, many of whom have careers in health care. It is designed to serve passengers who cannot or will not be taken by conventional TNCs. Lift Hero also offers many of the same features available from other TNCs, including online payment, rating, and feedback systems (95).

### ***Dispatcher Programs***

Recognizing that there are numerous companies (taxicabs and TNCs) that offer rides to older adults, some companies have developed dispatcher programs to make it easier for older adults to arrange transportation. Dispatch companies offer the ability for older adults to call operators to schedule rides with TNCs and taxi companies. Below are examples of dispatch programs that provide this service to older adults in Texas.

### ***GoGoGrandparent***

GoGoGrandparent acts as a dispatcher for Uber and Lyft to provide rides specifically to older adults. Older adults who have difficulty using phone applications or do not own a smartphone can use the service to have access to surrounding TNCs. Users call GoGo operators, and operators order a ride from a TNC to arrive at the user's home. Users pay with a credit card over the phone and do not pay the drivers directly. Operators screen and monitor rides to ensure completed safe rides. GoGoGrandparent 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. The service operates in all 50 states (96).

### ***GreatCall Rides***

GreatCall Rides works with Lyft to provide transportation to older adults through Jitterbug phones. Jitterbug phones are basic, non-smartphones that cater to older adults. Through their Jitterbug phone, customers press "0" and request a ride through an operator. The operator then requests a ride through Lyft's concierge platform. Lyft then contacts the assigned driver and informs him or her that he or she will have an elderly rider. The rider is then 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. The service is currently piloting in areas that have a significant population of older adults. In Texas, the service operates in the Dallas/Fort Worth area as of August 2016 (94, 97, 98, 99).

### ***RideWith24***

RideWith24 is another dispatching service for older adults. The program was developed by 24Hr Homecare in partnership with Uber. The program partners with the Open Doors Organization to train Uber and taxi drivers to accommodate older passengers who may have physical limitations. The program is available to the public through a toll-free number. Services are offered 365 days



a year and promise single rides, repeated rides, and same-day rides within 15 minutes of request. The service is available in the Dallas area (97, 98, 100).

### ***Key Findings for the Aging Population and Ride Services***

The following are key findings for ride services, including volunteer driver programs, for-hire services, and dispatch programs.

#### ***Key Takeaways: Volunteer Driver Programs***

Volunteer driver programs fill a gap that many transportation services, such as public transportation and paratransit, cannot provide. In addition, volunteer driver programs often offer companionship and combat isolation that many older adults face. Volunteer driver programs are instrumental for older adults who cannot afford for-hire services, and in the case of programs that provide reimbursement for drivers, it is a small but reasonable incentive for family and friends to continue to provide rides for older adults. While there are many different types of volunteer driver programs (from small, community-based programs to national programs), they remain an integral part of transportation for the aging population. One of the significant weaknesses that volunteer driver programs pose is that older adults who are not ambulatory are often not accepted by the volunteer driver programs.

#### ***Key Takeaways: For-Hire Ride Services***

The significant issue associated with taxis and TNCs is the cost. Studies have found that older adults perceive using taxis as more expensive than owning a vehicle and therefore choose other options like asking a friend or family member rather than taking a taxi. For older adults, taxicabs and TNCs are a luxury as opposed to a viable option. While some programs offer subsidies for older adults to use taxis, demand continues to grow for these services, which reduces the general availability of taxi service for the aging population. Some cities in the United States are attempting to address this issue by subsidizing TNC rides as well (15, 18, 101, 102, 103).

An additional issue with taxis is the perception of safety. For older adults who have the option to drive, about 3 percent choose taxis as an alternative to driving due to insecurities about safety. Moreover, an AARP study found that older adults, particularly women, do not feel comfortable riding with a stranger. Older adults' concern with safety extends to fears that they will not be able to be safely accommodated by TNC or taxi drivers. Drivers who are not trained to provide assistance may have difficulty aiding older passengers who need it and may deny rides or react adversely in a response to a request for assistance, which can cause older adults to feel unsafe when requesting assistance. Programs that provide training on how to safely accommodate older drivers can address this problem and improve the aging population's perception of the relative safety of for-hire services (15, 87, 104, 105, 106).

While the standard use of taxicabs and TNCs may have impediments to widescale use by older adults due to cost and perception of safety, examples of TNC platforms that are designed specifically for the aging population provide potential solutions to these shortcomings. Specifically, Lift Hero in California is an example of an approach to try to match TNC service to



the needs of the aging population and serves as a model for other TNCs and taxi companies to replicate.

### ***Key Takeaways: Dispatcher Programs***

Dispatcher programs designed to improve access to for-hire ride services provide a great opportunity for older adults to increase their mobility options. Ultimately, these programs are a great option for the segment of the aging population that can afford for-hire services, and these services will likely continue to evolve and grow, but they will still only serve the small portion of the population that can afford market rate for-hire ride services.

## **Active Transportation and the Aging Population**

Walking and biking are forms of active transportation that can increase the mobility of older adults, support healthy aging, and provide opportunities for older adults to stay physically and mentally fit. There are numerous benefits to encouraging active transportation among older adults; several studies suggest that maintaining some form of active transportation is a critical part of preventing disability and/or institutionalization (46, 107). In addition, research shows that moderate levels of daily activity achieved through active transportation can be beneficial for the physical health of older adults. Activities such as walking or biking can reduce the risk of some diseases and limit the threat of depression (107, 108). Another benefit of active transportation is the ability for older adults to make the many short trips that are typical of the aging population without having to rely on others for transportation or incurring the elevated risks associated with driving themselves (31).

According to an evaluation by the AARP Public Policy Institute of the aging population's travel habits based on the 2009 National Household Travel Survey, walking was found to be the second most common travel mode for older adults. The proportion of walking trips among adults aged 65 and older was 8.8 percent (compared to 2.2 percent for public transportation and 0.2 percent for taxis) (109).

The following subsections provide:

- A discussion of issues identified in the literature review related to walking and biking among the aging population.
- Examples of programs that help older adults participate in active transportation.
- Key findings regarding the aging population and active transportation.

### ***Issues Associated with the Aging Population and Active Transportation***

Following is an overview of some of the issues that impact the aging population's ability to use active transportation modes.

### ***Limitations of Walking for the Aging Population***

For some older adults, walking can be a reliable travel option to reach nearby accessible amenities, particularly in urban areas. However, increased safety risks are associated with older pedestrians. Transportation for America reports that adults age 65 and older face a higher risk of dying as a pedestrian than do younger adults. This risk increases for adults aged 75 and older (12). While older adults rely on walking, the risks associated with vehicle-pedestrian crashes or falls can limit their use of this mode.

### ***Limitations of Biking for the Aging Population***

Biking offers a healthy option for some older adults. However, physical limitations and a lack of comfort or familiarity with this mode of transportation may prevent some individuals from biking. Like walking, bicycle safety is a primary concern expressed by older adults (8). A lack of knowledge of road rules while cycling can also contribute to safety issues for older adults. Bicycle education and training is a strategy that can help alleviate concerns or fears regarding bicycling and can help older adults feel safe in these situations (8).

Accessibility is also an issue for older adults using bicycles because bike paths lack connectivity or are nonexistent in some areas. Many bike paths are immediately adjacent to vehicle traffic, which contributes to bicycle safety concerns for older adults. Separated bicycle facilities (also called protected bike lanes or cycle tracks) offer a more comfortable option for older bicyclists and serve as “one of many bicycle facility types that can be used to create a connected network” (8). FHWA defines a network as “interconnected pedestrian and/or bicycle transportation facilities that allow people of all ages and abilities to safely and conveniently get where they want to go.” In a rural area, a shared-use path or a wide shoulder could be an appropriate option for an older bicyclist (8).

### ***Safe and Accessible Streetscape Design***

The design elements of pedestrian facilities are extremely consequential when considering the accessibility, safety, and comfort of older adult pedestrians. Research found that older adults living on a block with accessible sidewalks were significantly more likely to be mobile (47). Factors such as safe sidewalk design, high connectivity, and accessible physical environment improve accessibility for older adults:

- *Safe sidewalk design*—Safe and accessible pathways were cited as primary concerns for the walkability of neighborhoods for older adults (46). Safety is defined by walkways that are consistent (i.e., connected), accessible (curb cuts, low curb height), and a safe distance from other forms of traffic (cars and bicycles) (47). Sidewalk design characteristics to improve accessibility include wider sidewalks, smooth pavement, lower curb heights, and frequent curb ramps. Wide, paved sidewalks reduce the risk of falling and make it easier to use walking assistance tools, such as walkers and canes. Standard curb heights can be too high for older adults to navigate, and a lack of curb ramps can increase the risk of falling and make entering and exiting sidewalks difficult, particularly

for older adults with limited mobility or who require walking assistance tools (46, 110). Inaccessible sidewalk design can prevent older adults from making trips and can create risks of isolation, institutionalization, and even death for older adults (47).

- *High connectivity*—Neighborhoods with high connectivity include crosswalks and longer walk signal times that improve accessibility for older adults. FHWA’s *Handbook for Designing Roadways for the Aging Population* notes that older pedestrians may have a shorter stride, slower gait, and delayed reaction time compared to younger adults. To accommodate these needs, the handbook suggests that when planning crosswalks, designers should use a walk speed of 3 feet per second when calculating the walk times for pedestrian signals, which will result in longer crossing and countdown pedestrian signal times (shown in Figure 4) (32). In addition, marked crosswalks provide a delineating line to separate vehicle traffic from pedestrians. Raised crosswalks can encourage drivers to reduce speed and can increase the visibility of pedestrians by drivers. These design elements can reduce the risk of pedestrian accidents when older adults are crossing the street (108, 111).



Source: (32).

**Figure 4. Countdown Pedestrian Signal.**

- *Accessible physical environment*—Characteristics of the physical environment, such as walking paths separated from roads, landscaping aesthetics, and well-lit walkways, can also encourage older adults to walk more often. Walking paths, such as trails through parks and other non-sidewalk paths, create a safe, quiet, less populated environment for older adults to walk (111). Walking paths that provide access to necessary amenities increase the likelihood that the paths will be used by aging adults (112). Studies have also shown that walking among older adults may be encouraged by greenery, attractive neighborhood aesthetics, mixed land use, and diversity in building height (12, 47, 111, 113). Well-lit walkways are another attribute cited as a built-environment feature that increases the perception of safety (114). Finally, researchers found that areas with challenging topography such as slopes and hills can make walking problematic for older adults (114).

### ***Educating Older Adults about Pedestrian Safety***

NHTSA provides effective strategies to educate older adults about pedestrian safety in its 2013 report *Identifying Countermeasure Strategies to Increase Safety of Older Pedestrians*. The report provides specific training on how to walk in a complex street environment and also includes educational lessons and tools for those who want to provide training to older adults regarding safe pedestrian practices. Examples of the lessons include:

- How to judge the speed of the vehicles.
- How to judge the availability of a gap that meets one’s walking speed.

- How to avoid dangerous intersections and backing vehicles.
- How to be conspicuous to other users of the sidewalk and roadway (115).

### *Programs for the Aging Population and Active Transportation*

The following are examples of programs to increase the ability and opportunity for older adults to participate in active transportation, such as walking and biking. Walking and biking opportunities exist in Texas, but few examples of programs to enable active transportation for older adults were identified for this research.

#### ***NHTSA Pedestrian Safety Workshop for Older Adults***

NHTSA and the University of North Carolina Highway Safety Research Center developed a guidebook for conducting a pedestrian safety workshop. The guidebook provides materials and curriculum to conduct a workshop to teach older adults to be safe while walking and to educate them on how driver behavior, the physical environment, and traffic law enforcement can help improve walking conditions. Pedestrian training can improve older adults' ability to walk in urban, suburban, and rural settings. The NHTSA training guidebook is an example of an out-of-the-box approach that provides organizations interested in conducting pedestrian training with the tools necessary to do so (116).

#### ***Safe Routes to Age in Place (Miami, Florida)***

The Miami-Dade Age-Friendly Initiative includes a Safe Routes to Age in Place (SRTAP) program that supports active transportation across age groups. SRTAP fosters accessible, safe, comfortable, and appealing active transportation by measuring the walkability of neighborhoods with high densities of older adults and implementing design initiatives to improve pedestrian accessibility. The initiative has also targeted age-friendly business districts and age-friendly parks to ensure high access to amenities among older adults (117).

#### ***Walk Texas!***

The Texas Department of Health Diabetes Program developed the community-based Walk Texas! program to promote walking as a way to help prevent or manage chronic diseases such as diabetes. The primary target population for the program is adults ages 50 and older who are at risk for or diagnosed with Type 2 diabetes. Walk Texas uses a community-based approach to encourage physical activity that can produce health benefits (118).

#### ***Bike Training Program for Older Adults***

The Parks & Recreation Department of Portland, Oregon, runs a cyclist program for adults 60 years and older called Biking is Back. The program holds classes on a car-free trail in Portland and provides helmets and three-wheeled bicycles (119).

### *Key Findings for Active Transportation and the Aging Population*

Active transportation offers a mobility option for older adults that can be safe, healthy, and inexpensive. More trips being made by these nonmotorized modes may also serve to reduce strain on the rest of the transportation network. However, walking and biking opportunities are limited by both the physical limitations among individual adults and the physical environment in many communities.

## Chapter 5: Area Agencies on Aging

AAAs are regional entities that plan, develop, coordinate, and deliver a range of community-based services for adults over age 60. Because AAAs are local community-based entities, they are empowered with the flexibility to provide a wide range of services that are tailored to their planning and service area. Each AAA develops an area plan that reflects the needs and demands of the local communities that it serves.

Transportation is one of the critical supportive services that AAAs provide, but they also help older adults find and access community resources, programs, and services; understand Medicare and other benefits; and provide direct support such as meals and day care (120). While primarily a health and human services program, a survey of AAAs found that 48 percent of transportation users served by the AAAs relied on transportation services under the Older American Act for almost all of their rides (121). In 2010 alone, 25.6 million rides were offered or arranged by AAAs nationwide (122).

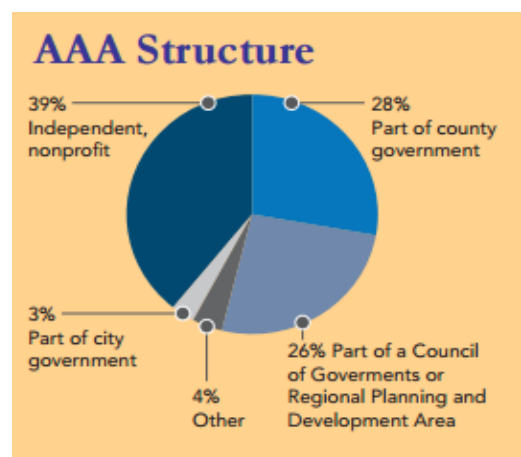
According to a survey of AAAs nationwide, 84 percent partner with transportation agencies. Over 70 percent of AAAs also work with partners on the development of livable communities. Examples include the following practices:

- 81 percent of AAAs have adopted practices to address housing, transportation, land use, and other development issues with other public entities.
- 50 percent of AAAs have adopted projects to promote aging in place (123).

AAAs fund services such as volunteer driver programs, directly provide some transportation services, act as a portal to connect individuals to existing services and information, and partner with public and private entities to improve the ability of older adults to get access to the transportation services they need. In addition to directly providing transportation and access for older adults, AAAs present one of the most predominant examples of a longstanding model of program delivery in rural, suburban, and urban communities.

### Background

As noted in Chapter 3, programs funded through the OAA are implemented by a national network of state and local AAAs and partner organizations that coordinate and deliver community-based services to older adults (120). AAAs can be organized as independent, nonprofit organizations or as part of government entities (see Figure 5). AAAs also vary widely in size because the geography and population



Source: (120).

**Figure 5. AAA Organizational Structure Summary.**

of each state determines how many AAAs to establish. For example, Wisconsin has three AAAs, while New York has 59. Texas has a network of 28 AAAs across the state, and its network is discussed in more detail below.

AAAs are supported by funding from the OAA, other federal sources such as Medicaid, and non-federal sources, including state and local funding, grants, and cost-sharing consumer contributions. In 2013, the average budget among the more than 600 AAAs in the country was \$9.4 million, with a range of \$138,000 to \$292 million. AAAs receive an average of 40 percent of their funding from the federal OAA, but this can range from 1 percent to 100 percent of an individual AAA's budget. Table 4 provides a summary of AAA budgets.

**Table 4. AAA Budgets.**

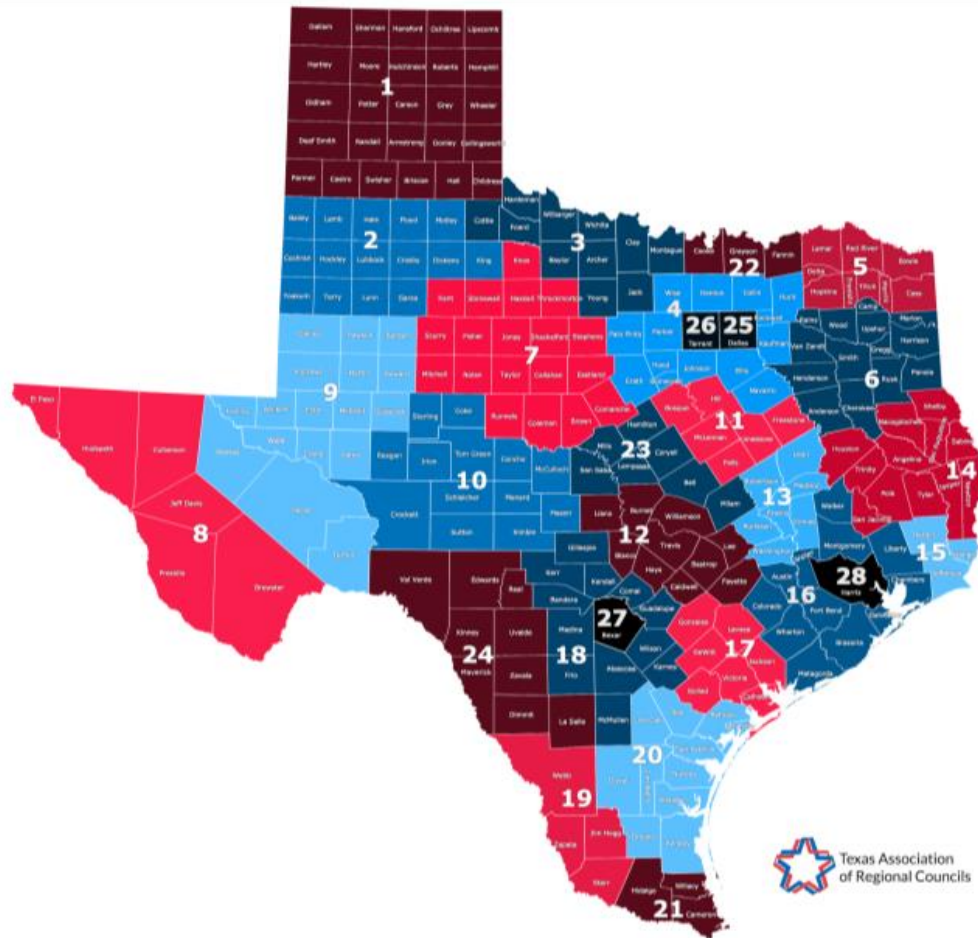
|                                    | <b>Average</b> |             | <b>Median</b> |             | <b>Range</b>             |                          |
|------------------------------------|----------------|-------------|---------------|-------------|--------------------------|--------------------------|
|                                    | <b>2010</b>    | <b>2013</b> | <b>2010</b>   | <b>2013</b> | <b>2010</b>              | <b>2013</b>              |
| Budget (in millions)               | 8.9            | 9.4         | 4.0           | 3.9         | < 150,000 to 167 million | < 138,000 to 292 million |
| Proportion of budget from OAA      | 40.7           | 41.1        | 35.0          | 35.0        | 1–100                    | 1–100                    |
| Proportion of Budget from Medicaid | 24.5           | 26.9        | 17.0          | 20.0        | 1–95                     | 1–93                     |

Source: (120).

## AAAs in Texas

In Texas, a network of 28 AAAs serves adults 60 years and older, prioritizing individuals who have limited incomes, minorities, and individuals with disabilities. The OAA provides grants to states, area agencies, and local agencies to provide older adults access to health, nutrition, and other community services. The Texas Department of Aging and Disability Services (DADS) within Texas Health and Human Services is responsible for administering OAA programs under a statutory mandate to develop and strengthen services for the state's elderly population. Funds are passed through the DADS, which contracts with the 28 affiliated AAA planning and service areas across the state to provide services to anyone 60 and older. The 28 AAA regions in Texas are shown in Figure 6.





Source: (124).

**Figure 6. 28 AAA Regions in Texas.**

Administrative requirements for AAAs are outlined in the Texas Administrative Code, Title 40, Part 1. The code outlines numerous objectives that the AAA aims to achieve, including outcomes that guarantee that “access and assistance services are accessible, flexible, coordinated and designed to support an individual’s highest level of functioning in the least restrictive environment” (125). Transportation services provided under the OAA and funded by Texas DADS are regulated by Rule §85.301, Transportation Services (126).

The role of AAA is often a sub-function of other regional government or planning organizations. AAAs in Texas are typically housed within regional organizations such as councils of government (COGs) or regional planning agencies (RPAs). This tendency is more common in Texas than across the country, as shown in Table 5. The largest urban areas are served by several AAAs. For example, most of the greater DFW region is part of the North Central Texas AAA (part of the North Central Texas Council of Governments), but Dallas County and Tarrant County each have an AAA. In rural regions, AAAs serve large geographic areas that include multiple counties. For example, the Panhandle AAA (Region 1 on the map in Figure 6) services 26 counties.



**Table 5. AAA Organizational Structure Summary.**

| <b>AAA Structure Type</b>     | <b>Nationally<sup>a</sup></b> | <b>Texas<br/>(n = 28)<sup>b</sup></b> |
|-------------------------------|-------------------------------|---------------------------------------|
| COG, RPA, or Development Area | 26%                           | 89%                                   |
| Independent, Nonprofit        | 39%                           | 7%                                    |
| County Government             | 28%                           | 0%                                    |
| City Government               | 3%                            | 4%                                    |
| Other                         | 4%                            | 0%                                    |

<sup>a</sup> Source: National Association of Area Agencies on Aging national study of AAAs.

<sup>b</sup> Source: DADS data.

While not the primary focus for AAA, transportation is considered a major barrier to connecting members to other health, nutrition, and social services. AAA transportation services include information and referrals to other operators, demand-response transportation, and voucher programs. For example, the East Texas AAA lists among its services “rides to essential destinations such as nutrition sites, senior centers, doctors’ appointments, and grocery shopping” (127). The Nortex Regional Planning Commission surveyed organizations identified as providing transportation services in 2012 for its updated Regionally Coordinated Transportation Plan. Among 13 organizations, 12 reported transportation services among their primary mission. Other than the Wichita Falls Transit System, most of the providers serve almost exclusively older adults. Notably, trips are provided for a range of purposes. Personal business, medical, and group meals were the most commonly cited by providers, but work and job training were also reported by five providers.

The rest of this section presents examples of transportation services offered by several Texas AAAs that fulfill needs in urban, suburban, and rural settings.

*Many people living throughout the Panhandle travel to Amarillo for their medical care, especially for specialty care doctors. As a person grows older and becomes more frail, driving into Amarillo becomes less feasible both physically and financially, which results in an access barrier. It also forces residents to consider leaving their homes and moving to Amarillo. The size of the region is also difficult for many to comprehend; the Panhandle is roughly 10 percent of the land area of the State of Texas. For example, traveling to Amarillo from Booker and back (northeast section of region) is 266 miles, Texline (northwest) is 242 miles, Childress (southeast) is 235 miles, and Farwell (southwest) is 193 miles (Quote from Panhandle Regional Planning Commission, 2015–2016 Area Plan [129]).*

## *Panhandle AAA*

The Panhandle Regional Planning Commission (PRPC) is the AAA for the 26-county Panhandle region. One of the most rural regions of Texas, the Panhandle includes over 420,000 residents in nearly 26,000 square miles (128). As the regional planning organization for the region, PRPC is also involved in criminal justice, economic development, emergency preparedness, water planning, and regional transportation planning. While the central focus of the AAA is on health care and human services, PRPC states that the “major barrier that the target population faces is transportation. It has ripple effects in all aspects of care and service to the aged” (129). In PRPC surveys of local governments, senior centers, and the aging population, transportation is consistently cited as a top priority or need.

To serve this need, the PRPC AAA offers demand-response transportation and home-delivered meals. These services are delivered using direct purchase of services, which is financed from a pool of funds for various services that enable staff to prioritize older individuals with the greatest economic and social needs. For example, a transportation voucher fund helps individuals pay for their own transportation to access services. The 2017 budget includes 3,000 one-way trips as part of services (130). PRPC AAA staff also participate in regional efforts to improve transportation for older adults.

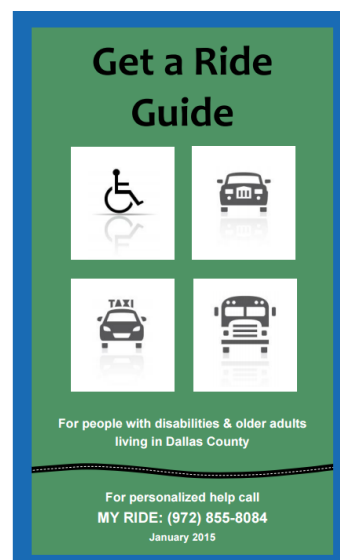
The Panhandle region highlights both the variation in population distribution across Texas and the challenges that face rural areas. According to the Panhandle AAA Area Plan for FY 2015–2016, 46 percent of the 60 or older population lives in 24 rural counties (129).

## *Dallas Area Agency on Aging*

Older adults in the Greater Dallas Area are served by the Community Council of Greater Dallas (CCGD), which is the umbrella organization of the Dallas AAA. According to its website, CCGD has assisted 54,750 older adults (131). One service it provides is called My Ride Dallas, a coalition of more than 90 organizations that work together to expand transportation options for older adults and individuals with disabilities (132). The My Ride program includes a guidebook, shown in Figure 7, that introduces travelers to all the transportation options available to them in Dallas County. It includes costs, schedules, required advanced notice, and type of service. The program also offers travel training and limited vouchers to pay for rides (133). In urban regions like Dallas, Texas’s older adults have access to a larger pool of potential travel options.

## *Bexar Area Agency on Aging*

One example of an AAA with an outstanding reputation in Texas is the Bexar Agency on Aging, which serves the city of San Antonio and Bexar County. The



Source: (133).

**Figure 7. Dallas County Transportation Guidebook for Older Adults.**

Bexar AAA is housed with the Alamo Area Council of Governments (AACOG). The Bexar AAA provides a range of services to older residents to enhance their ability to age in place, including door-to-door trips to nutrition sites, local medical services, and social service agency appointments (134).

Notably, the Bexar AAA provides two programs that are nationally recognized as best practices: Call a Ride for Seniors and Call-A-Ride 4 Vets.

### ***Call a Ride for Seniors***

The Call a Ride for Seniors program coordinates four volunteer driver nonprofits to provide escorted transportation to older adults in San Antonio and Bexar County. The program also conducts research regarding gaps in service areas, senior-dense areas, and high-need areas within the region. In addition, the program developed a guide for older adults to assist them in getting around Bexar County and the surrounding region and publishes a monthly newsletter to inform individuals of new and changing services (135).

### ***Alamo Call-A-Ride 4 Vets***

The Alamo Call-A-Ride 4 Vets program provides on-demand transportation for veterans and their spouses living in the 13-county AACOG planning region (136). A \$300,000 grant covered 18 months of the program and provided more than 5,000 rides, typically to access health and mental health care services and other benefits.

## **Key Findings for AAAs and Transportation for the Aging Population**

In the pursuit of transportation solutions for healthy aging among older adults in Texas, AAAs offer a well-established and state-supported network of organizations that are engaged with the older population locally across Texas. AAAs are designed to help older adults find and access community resources, programs, and services, including transportation, which has been identified as a primary hurdle for older adults trying to access various services that can contribute to healthy aging.

AAAs have an established network designed to reach older adults across the state that can be leveraged to expand transportation options for older adults. Nearly three-quarters of AAAs nationwide also serve as aging and disability resource centers (ADRCs) that connect individuals to information and counseling on long-term service and support (137). In 2008, only 9 percent of AAAs performed ADRC functions, which demonstrates that there has been an increased consolidation of senior services nationally over the last decade (137). Furthermore, AAAs are already frequent partners with transportation agencies (52 percent of AAAs report partnering with transportation agencies).

AAAs also commonly partner with State Health Insurance Assistance Programs (69 percent of AAAs have a formal partnership) and Medicaid (52 percent). For example, a partnership with Sam's Club Pharmacies has led to in-store health fairs and information kiosks. HHS provides

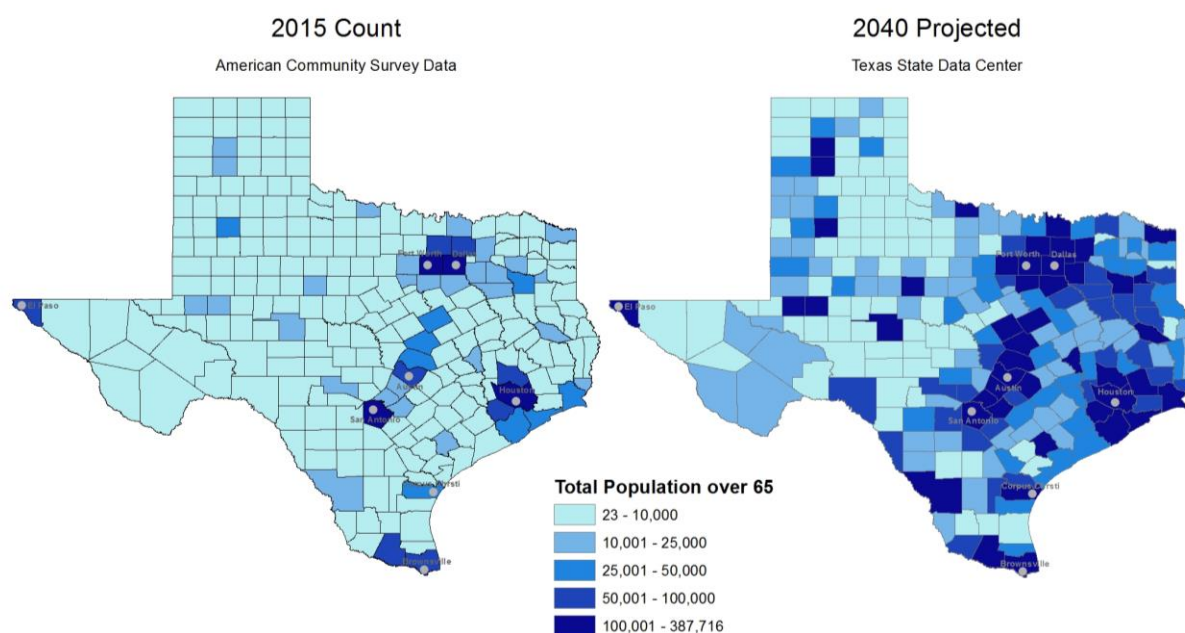
outreach materials, and AAA or HHS employees do outreach (138). AAAs also partner with wellness programs that support walking, like Texas Healthy Communities and Walk Across Texas (139). These examples demonstrate opportunities to reach older adults through existing AAA programs to inform individuals about transportation solutions for healthy aging.

## Chapter 6: Demographic Analysis of Aging Texans

This chapter provides a demographic overview of the aging population in the state of Texas, including how the aging population is geographically dispersed throughout the state and how this segment of the population is projected to grow in the future. In addition, this chapter presents an analysis of mobility need for the aging population in the state of Texas. Researchers developed a mobility need index (MoNI) to analyze key demographic characteristics that indicate the presence of older adults who are likely to have mobility needs or challenges.

### The Aging Population in Texas

Projections by the Texas State Data Center (TSDC) note that given a similar pattern of in-migration that Texas experienced between 2000 and 2010, the proportion of the population in Texas that is age 65 and older is projected to increase from 11.5 percent in 2010 to 20 percent in 2040 (2). Researchers used American Community Survey (ACS) data and population projections from TSDC to see how and where the aging population is expected to grow in Texas over the next 25 years. Figure 8 presents two maps that compare the absolute number of adults 65 years or older by county in 2015 to what is projected in 2040.



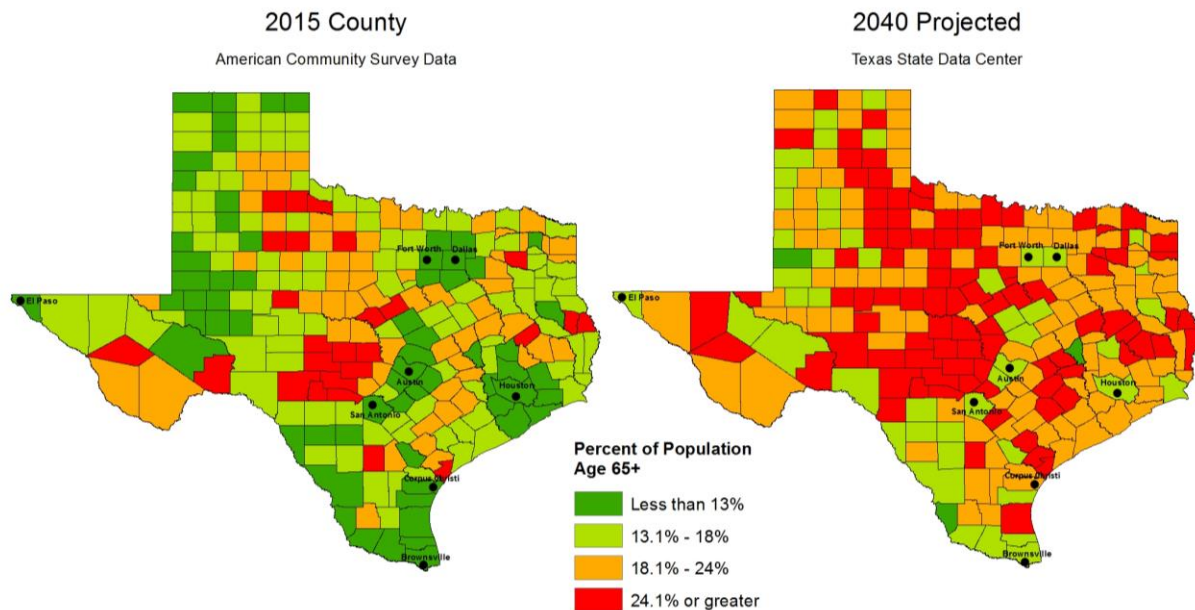
Source: (140, 2).

**Figure 8. 2015 and 2040 Projected Population over 65 in Texas.**

As shown in Figure 8, the counties with the largest populations age 65 and older are urban counties, including Harris (Houston), Dallas and Tarrant (DFW), Travis (Austin), Bexar (San Antonio), El Paso, McAllen, and Cameron (Brownsville) Counties. Between 2015 and 2040, the urban cores are expected to continue to capture the most absolute population growth of

Texans aged 65 and older, but suburban and rural counties surrounding many of the urban core counties will also experience significant growth of the aging population.

Researchers also documented the proportion of population age 65 and older within each county. Figure 9 presents two maps that compare the proportion of Texans age 65 years or older in each county in 2015 to the projected proportion in 2040.



Source: (140, 2).

**Figure 9. Proportion of Population over 65, 2015 and 2040.**

As shown in Figure 9, the counties that had the highest proportion of Texans age 65 and older in 2015 were suburban and rural counties. By 2040, many more suburban and rural counties will have a higher proportion of Texans age 65 and older. While the absolute number of older adults in urban counties is projected to increase over the next 25 years, rural and suburban counties are more likely to have a greater proportion of adults 65 years or older.

## **Key Demographic Findings for the Aging Population in Texas**

The majority of older adults in Texas live in urban core counties. The older adult population in urban areas is projected to continue to increase through 2040. Over the same period, the population of older adults in suburban and rural counties surrounding urban cores is also projected to significantly increase.

Based on an evaluation of the proportion of older adults in counties throughout the state of Texas, rural and suburban counties currently have larger proportions of older adults than their urban counterparts. This trend is also projected to continue, with rural and suburban counties projected to become increasingly older over the next 25 years.



## Mobility Need Index for Aging Population in Texas

While the previous section of this chapter identified where within the state the aging population lives both currently and in the future, researchers recognize that there are other demographic factors that indicate mobility need. This section uses a selection of demographic information that indicates a likelihood of increased mobility needs to determine where the greatest mobility need for the aging population exists within the state of Texas.

Researchers developed a MoNI to geographically identify areas in Texas that display higher mobility needs. The MoNI is calculated as a single index (i.e., an indicator) based on a set of demographic characteristics that are associated with mobility challenges among the aging population. Data were retrieved from the U.S. Census Bureau's 2015 ACS 5-year data. Factors selected for the MoNI include subsets of the older adult population by age and demographic characteristics, such as older adults with no vehicle in household, poverty status, and disability status. A weight was assigned to each factor based on researchers' understanding of its relative significance in reflecting higher mobility need. For instance, individuals age 85 or older are more likely to not drive, to have difficulty walking unassisted, or to face other limitations than young-old individuals between age 65 and 74. In calculating the MoNI, the age 85 or older characteristic was assigned a larger weight than the age 65 to 74 characteristic. Table 6 summarizes the list of characteristics and weights used in the MoNI.

**Table 6. Characteristics for the MoNI.**

| <b>Characteristic</b>                      | <b>Weight</b> | <b>Justification for Weight Value</b>                                                                                                                       |
|--------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Age 65–74 (young-old)                      | 0.5           | Young-old adults are the least likely segment of the aging population to have mobility challenges and are often still working, driving, and in good health. |
| Age 75–84 (old)                            | 1             | Adults in the 75–84 age segment face increased mobility challenges as transportation options, such as operating an automobile, become more limited.         |
| Age 85 and over (old-old)                  | 1.5           | Old-old adults have more mobility challenges and fewer options (e.g., inability to walk unassisted).                                                        |
| Persons living in poverty age 65 and over  | 1.5           | Lower-income populations have less access to services such as taxis and TNCs and are more likely to have to rely on public services for transportation.     |
| Households with no vehicle age 65 and over | 1.5           | Low vehicle access reflects populations that do not have the option to drive themselves.                                                                    |
| Persons with a disability age 65 and over  | 1.5           | Individuals with disabilities have increased mobility challenges and may require access to specialized transportation options.                              |

For each factor, the absolute number of individuals in each county with that characteristic was gathered from the census data. That number was divided by the land area of the county to

calculate the density of persons per square mile with that characteristic. For example, the age 65 to 74 characteristic is a value that represents the number of people between the age of 65 and 74 per square mile in each county.

Finally, each factor was mathematically transformed to account for the variation in population between Texas counties. County population and population density varies significantly from the largest county (Harris County, population of 4.5 million in 2015) to the smallest (Loving County, population of 112 in 2015). The data were transformed into a logarithmic function that counteracts the skew toward larger values and makes it easier to compare widely varying values. This allowed for more variance to highlight areas outside of the most populous counties. The Appendix provides a detailed description of the methodology used to develop the MoNI.

Figure 10 shows the results of the MoNI. The map indicates areas of higher mobility need in orange and lower mobility need in green. The highest mobility need appears in counties with heavy populated urban areas. One exception is Gregg County, located about 100 miles east of Dallas, which stood out among the highest mobility need counties. This small but heavily populated county has over 120,000 residents. The MoNI was high in Gregg County due to a larger number of persons over 65 per square mile.

The lighter orange color highlights counties that have a high mobility need. Most of these counties are located around major metropolitan areas. Some counties around smaller urban areas such as the Panhandle and Midland-Odessa area show a high mobility need. Areas in yellow fall around the average levels of mobility need. Areas in shades of green show lower need and include many rural counties. This finding does not necessarily mean that a need is not present; rather, it reflects counties where the number of people with mobility need per square mile is low.

These results closely mirror the future population density projection map. Since the MoNI takes population density into account, most of the high need is located around populous urban areas. Judging from a state perspective, areas with a high MoNI are mainly in the eastern part of Texas, mostly because it is more populated. According to the State Demographer's Office, the parts of Texas east of I-35 contain 86 percent of the state's population (141). The MoNI map also suggests a relatively high level of need within the Texas Triangle—the area within the DFW, Houston, Austin, and San Antonio network. These areas contain high populations of people 65 and older as well as high mobility need characteristics.



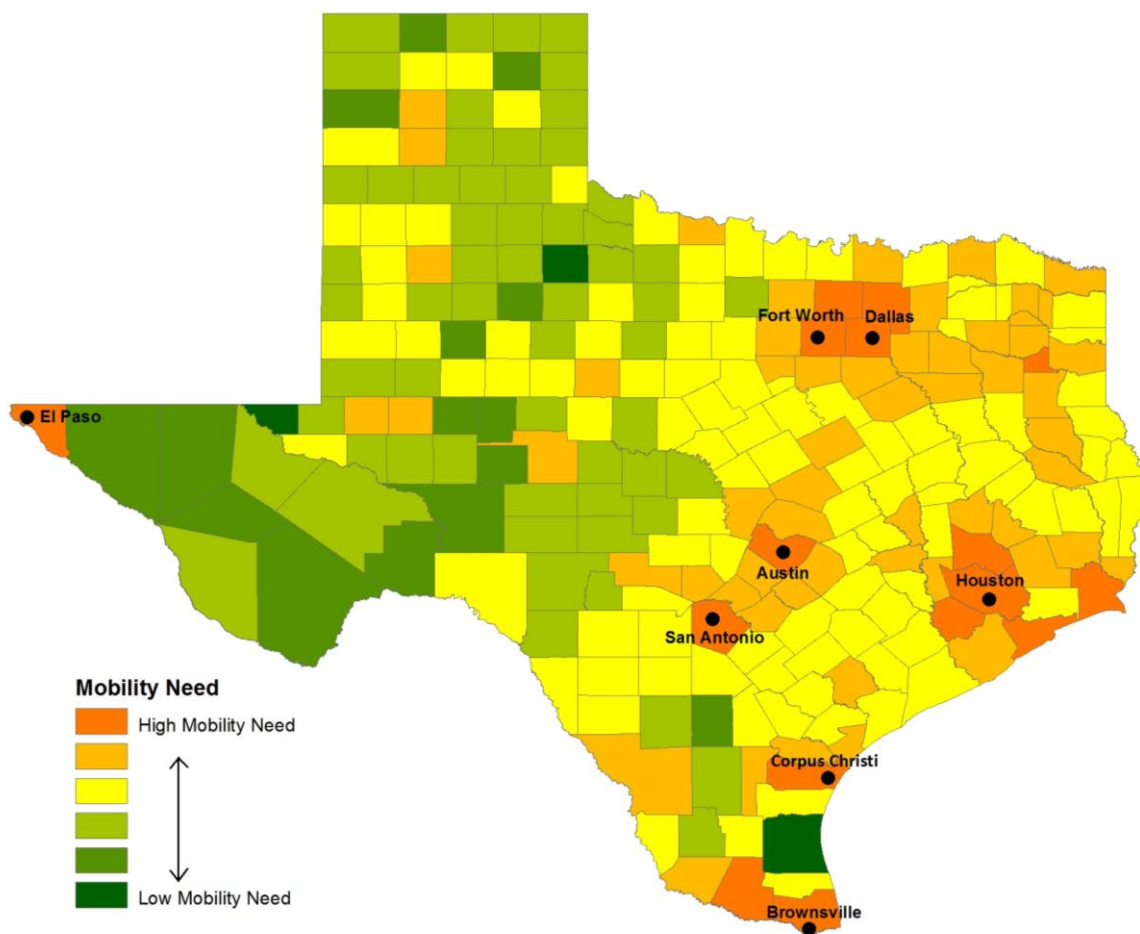


Figure 10. Results of Mobility Need Analysis.

## Key Findings of Demographic Analysis of Aging Texans

The MoNI provides a spatial analysis of the mobility needs for older adults across the state of Texas. Areas with higher densities of older adults without vehicle access, with disabilities, and living below the poverty line are expected to face greater challenges fulfilling their mobility needs. The MoNI reveals that Texas's core urban counties exhibit the greatest overall mobility need for the aging population.

There is also a significant—and growing—mobility need in rural and suburban locations adjacent to urban counties. Suburban and rural areas, especially near urban cores, exhibit high MoNI scores. In fact, these geographies are projected to have a larger proportion of older adults than their urban counterparts (see Figure 9). Moreover, the aging populations in these geographies are more at risk of suffering from a lack of mobility due to isolation and a lack of available transportation services than urban areas where services are more widely available.

## Chapter 7: Future Trends for Healthy Aging

---

The projected growth of the aging population confirms that the need for transportation services for older adults in the future will only increase. As the older population in Texas continues to grow, existing programs and services will have to find new ways to keep up with the consequent growing demand for transportation. As policy makers strive to identify innovative and effective solutions to serve older adults' transportation needs, two broad future trends are expected to be increasingly relevant. Researchers view future trends as not only new technologies but also best practices in planning and programming that are being applied in innovative ways to meet changing needs. Thus, two future trends that this research has identified as central to healthy aging for older adults in Texas are aging in place and new technology.

Aging in place—while not a new concept—is a planning perspective that is growing increasingly important because the widespread preference of older adults to be able to remain independent in their homes has been recognized. Examples of innovative ways that cities are shaping policy to specifically enable older adults to age in place are through infrastructure improvements and planning strategies. In addition, new technologies that are impacting how people of all ages access transportation services hold great potential to aid older adults in their ability to healthily age in place.

Examples of strategies to support aging in place and of emerging technologies that can help older adults improve their mobility (as well as maintain independence) are highlighted next.

### Programs to Promote Aging in Place for Older Adults

In recent years, a growing emphasis has been placed on helping older adults age in place. A 2015 survey conducted by the National Council on Aging found that 58 percent of adults 60 years and older have been in the same residence for more than 20 years, and 75 percent say they intend to stay in their current home for the rest of their lives (4). Fewer older adults (particularly among the young-old) are moving into nursing homes. While individuals become more likely to live in group housing or nursing homes as they age, the proportion of adults age 85 or older living in group housing has been declining since 1990 (142). Many of the programs and technologies identified herein endeavor to make it easier for older adults to remain in their homes. Other programs specifically focus on making neighborhood environments more conducive for older adults seeking to age in place. Targeted programs were not identified in Texas, but the concept of age-friendly developing and planning is increasingly being incorporated by planners and developers. Two examples from other regions are introduced here.

In addition to transportation services and programs that provide specific modal options for older adults, the desire to age in place is complicated by transportation challenges that prevent older adults from accessing necessary goods and services. Some strategies address the link between living arrangements and transportation by making it easier for older adults to access these services in their homes or communities.

### *Naturally Occurring Retirement Communities*

One strategy is to foster naturally occurring retirement communities to provide older adults access to services without having to travel long distances. This program does not directly provide transportation services, but it improves access to amenities and allows older adults the ability to walk to services in their immediate community.

Naturally occurring retirement communities' supportive service programs (NORC-SSPs) support the development of priority services (e.g., grocery stores, pharmacies, doctors' offices) in target areas with existing high concentrations of older adults who do not currently have adequate access to these amenities. NORC-SSPs assess and define needs of areas that include large populations of older adults to provide solutions that reduce the need for older adults to leave their homes and social communities. The program is administered by the National NORCs' Aging in Place Initiative organized by the United Jewish Communities. Services provided in these areas by NORC-SSPs help to fill gaps in service in these areas. There are several types of NORC programs, but following are some key attributes of locations where NORCs typically operate:

- Areas where concentrations of older adults live near each other but have little or no existing social interactions.
- Urban areas, with few occurring in rural and suburban areas.
- An age-integrated building or neighborhood for older adults to intermingle with younger residents.
- Areas with some level of involvement of elders in the planning of services and activities.
- Areas with contracts or partnerships with one or more local service providers.
- Areas with volunteer opportunities for older adults (143).

### **Senior Pedestrian Focus Areas (New York, New York)**

Safe Streets for Seniors is a city pedestrian safety initiative for older adults in New York City that focuses on infrastructure improvements that directly serve older adults. The program identified 37 senior pedestrian focus areas in the five boroughs based on the density of senior pedestrian (age 65+) crashes resulting in fatalities or severe injuries in a 5-year period. The New York Department of Transportation evaluates crash rates and pedestrian conditions in these neighborhoods from a senior's perspective. Safety improvements are implemented in these areas, such as extending pedestrian crossing times at crosswalks to accommodate slower walking speeds, constructing pedestrian safety islands, widening curbs and medians, narrowing roadways, and installing new stop controls and signals. The program reports that senior pedestrian fatalities have decreased by 16 percent, from an average of 65 fatalities per year between 1999 and 2007 to an average of 54 between 2008 and 2016 (144).

## Technology to Support Healthy Aging for Older Adults

Many new technologies, bolstered by the widespread adoption of smartphones and Internet technologies, offer new ways for older adults to improve their access to transportation.

Technologies have also created new models of transportation provision that may provide lessons on how to provide services more efficiently. By extension, these technological tools can support aging in place by increasing independence and access to goods and services for older adults.

### *Transportation Network Companies*

TNCs offer an on-demand, curb-to-curb service that many consumers find more convenient and reliable than taxis, paratransit, transit, or other drivers. Several TNCs have launched programs and partnerships that are specifically designed to serve older adults (see examples in Chapter 5). However, TNCs are a for-hire ride service, and passengers must be able and willing to pay for that service. For many older adults, this practice may be considered a luxury akin to having regular access to taxicab service. These services may not be financially feasible for regular use for many older adults. However, TNCs have the potential to fill gaps in service, reduce reliance on family or volunteer drivers, and be tailored to the needs of older adults.

As a relatively new service, there is very limited information about the success of TNC services in serving the aging population. Furthermore, TNCs mainly operate in urban regions, and while programs like Liberty Now are exploring the potential for TNC services in rural areas, it is not clear that there is enough ride demand for TNCs to be successful in less dense areas.

TNCs currently operate in dozens of cities across Texas, but little is known about the ridership or travel behavior associated with TNC trips. According to the 2016 Texas Transportation Poll, about 22 percent of Texans surveyed have used a TNC. Furthermore, the survey also found that the likelihood of TNC use declines as the age of the respondent increases (145). The widespread adoption of TNCs among older adults, particularly among the old-old population, is limited by TNC services' reliance on smartphone technology and the cost to use TNC services.

Additional research is required to understand how these services will improve mobility for the aging population.

### *Advanced Vehicle Technologies*

Emerging automation technologies for new vehicles may allow some older drivers to drive more safely and later in life. Many of these technologies enable the vehicle to alert drivers to potential hazards or assist with elements of driving such as braking or lane control.

Advanced driver assistance systems (ADASs) are driving technologies incorporated into car design that aim to automate certain aspects of driving. These technologies may alleviate some of the difficulties that older drivers face when operating a vehicle and in turn may reduce crashes. However, many of these technologies are in either in the development or testing phase or have only recently become widely available to consumers, so the full scope and implications for driver

safety are not yet known. The following two categories of ADASs have been identified as useful to older adults while driving (146, 147).

### ***In-Vehicle Information Systems***

In-vehicle information system (IVIS) technologies are designed to provide the driver with information to make better driving decisions. IVISs allow older drivers to make improved driving decisions that are not critical to the immediate control of the vehicle (146, 148).

Examples of IVISs are congestion warning systems that communicate with other vehicles and use vehicle-location information to warn drivers about surrounding congestion. Studies show that these systems decrease mental workload to allow older drivers to prepare better for upcoming traffic (146, 149).

### ***Crash Avoidance Systems***

Crash avoidance systems use on-vehicle radars, cameras, and other sensors with computer intelligence to assess situations that could lead to a crash (146). For example, lane departure warning (LDW) systems utilize video camera and image analysis software to determine the location of lane markings relative to the vehicle. If the vehicle drifts too close to lane markings without the driver using his or her turn signal, the driver is given an auditory and visual alert to move back into the lane. LDW and other crash avoidance systems provide a supplementary mechanism to decrease the risk of an accident for older adults who may experience fatigue while driving (149, 150).

Two other automated features that are increasingly available and improve safety and make driving easier for older adults are the following:

- Adaptive cruise control (ACC) systems allow drivers to preset the distance they want between their vehicle and the vehicle in front of them. The system changes the car's speed to maintain the preset distance. ACC systems can reduce the burden of driving by giving older adults fewer tasks to manage while driving (148, 149).
- Adaptive headlight (AH) systems, also known as smart headlights, can turn the headlights in the direction of a curve, automatically dim high-beam headlights in the presence of oncoming traffic, and control the direction and intensity of the headlight beam when opposite traffic is approaching. Driving at night can become more difficult for older adults as visual ability declines. AH systems improve visibility while driving, which can reduce crashes at night (149, 150).

### ***Potential Barriers to Older Adults Using Advanced Vehicle Technologies***

Despite the potential benefits of ADASs, two possible barriers to older adults using these new technologies are the following:

- *Cost*—Cost can be a major barrier to the use of ADASs by older adults. Factors such as usability, functionality, and perceived benefits are strong considerations when weighing

ADASs against monetary costs. Surveys found that older adults would be more likely to purchase ADASs if they were less expensive. Individuals transitioning into retirement or working less may not have the means to afford vehicles equipped with these technologies. Older adults are also less likely to purchase ADASs because they are often sold in packages rather than separately and are often available only in luxury cars and not mid-range vehicles (151). Wider market penetration and lower costs for these technologies in the future could make these technologies more available for older adults, but currently they are not widely adopted.

- *Inadequate knowledge*—New vehicle technologies often require some form of instruction to ensure proper use. Many older adults are concerned by the possibility of malfunction with an ADAS in a critical safety situation. These concerns are often due to a lack of knowledge about how to use these systems, which can create a barrier to using them. Research found that if older adults felt they had adequate knowledge of a system, they would feel more comfortable and confident using it (108). Dealerships and automakers can help to assuage this discomfort for older adults by providing education and training about these systems (147, 149).

### *Online Shopping and Home Delivery Services*

Online shopping and home delivery services, such as Amazon Prime and Instacart, are increasingly common programs that can provide an alternative to travel, enable aging in place, and improve the health and quality of life for older adults. As individuals drive less or stop driving, access to goods and services can decline significantly. A Harvard Joint Center for Housing Studies report indicated that most older adults do not have access to grocery stores or other shops within walking distance (19). Online shopping has the potential to help mobility-impaired older adults accomplish some of their daily needs, such as shopping for food and other necessities.

Bolstered by the ease and popularity of online shopping, grocery stores, restaurants, and retail stores increasingly provide home delivery of purchased goods. Pharmacies often provide delivery services as well. However, Pew Research Center data from 2008 reveals that Internet users over the age of 65 comprise only 6 percent of online shoppers (152).

The success of home delivery has been demonstrated by the longstanding Meals on Wheels program, which delivers daily meals to older adults, typically those 60 years or older with limited mobility, through a network of 5,000 local programs and over 2 million volunteers nationwide. The costs for participants are set on a sliding scale, with no cost for some individuals, but in some areas demand exceeds supply, and individuals must be placed on a waiting list or turned away.

A 2015 study of Meals on Wheels found that meal deliveries can help individuals stay in their homes, can provide mental and physical health benefits, and can reduce overall program costs of caring for older adults at the state level (153). Each meal is delivered by a volunteer who



provides social interaction and a safety check on the meal recipient. Notably, nine out of 10 Meals on Wheels programs receive federal funding through the OAA (154).

## Key Findings about Future Trends

Two themes emerge as focal points for healthy aging of older adults: aging in place and new technologies. Aging in place is increasingly a priority for supporting healthy aging among older adults, but there are challenges to accomplishing this vision related to housing stock, financial needs, and the transportation limitations discussed in this report. New technologies have the potential to provide solutions for some older adults, but the degree to which technology can serve the needs of a growing aging population in Texas will depend on funding and technological adoption among this population. While many new technologies hold potential to expand travel options for older adults, many of them rely on mobile phones, Internet connectivity, and a familiarity with technology. These hurdles may limit who can benefit from programs like TNCs and Internet-based services.

The Pew Research Center offers some data on the ownership of computers and mobile devices among older adults in the United States (155). As shown in Table 7, adults 65 and older are less likely than all adults age 18 and older to own a computer, cell phone, or smartphone. However, adults between 50 and 64 are more likely than older adults to own computers and mobile devices, suggesting that the aging population of the future may be better equipped to take advantage of technological solutions.

**Table 7. Ownership of Computer and Mobile Devices in the United States in 2015.**

|                                  | Population Group by Age |       |     |
|----------------------------------|-------------------------|-------|-----|
|                                  | 18+                     | 50–64 | 65+ |
| Own a desktop or laptop computer | 73%                     | 70%   | 55% |
| Own a cell phone                 | 92%                     | 90%   | 78% |
| Own a smartphone                 | 68%                     | 58%   | 30% |

Source: (155).

More than half (59 percent) of U.S. adults over the age of 65 go online, according to research from the Pew Research Center. It is expected that older adults in the future will be more likely to use and be comfortable with the Internet. This statistic is reflected in Table 8, which shows that the proportion of Internet users among older adults 65–69 is approximately double the proportion of adults 80 years and older (156). Still, many older adults do not use or do not have access to the Internet.

**Table 8. Use of Internet by Age of Persons 65+ in the United States in 2013.**

|                        | <b>Age Group</b>  |              |              |              |            |
|------------------------|-------------------|--------------|--------------|--------------|------------|
|                        | <b>Adults 65+</b> | <b>65–69</b> | <b>70–74</b> | <b>75–79</b> | <b>80+</b> |
| Go online              | 59%               | 74%          | 68%          | 47%          | 37%        |
| Have broadband at home | 47%               | 65%          | 55%          | 34%          | 21%        |

Source: (156).



## **Chapter 8: Final Takeaways**

---

The following sections present the researchers' final takeaways from the research conducted in this study.

### **Mobility Options for Seniors Will Need to Be Expanded**

Research has shown that current transportation services do not adequately meet the existing mobility needs of the aging population, and with the large baby boomer generation at or nearing old age, the gap between existing services and future needs is expected to widen (157). While the overall mobility need for the aging population will continue to grow, the types of services that will be needed will grow more diverse. As discussed previously in this report, the mobility needs of young-old, old, and old-old seniors are unique to each particular group. Policies that aim to improve the provision of existing transportation programs and services for all segments of the aging population will be a key factor in the promotion of healthy aging for older Texans.

### **Patchwork Approach to Providing Transportation Services to the Aging Population**

The disaggregated and fragmented nature of how transportation services and programs for older adults are organized, and the range of organizations that administer these components of healthy aging, present challenges both in Texas and nationally. Gaining a better understanding of where and if improved organization and efficiency of programs, services, and providers might more effectively meet the transportation needs of an aging population may help policy makers develop new approaches and strategies to ensure the promotion of healthy aging of Texans.

### **Low-Income Aging Populations Need More Mobility Options**

While it is a challenge to ensure that the transportation needs of an aging population are met, meeting the transportation needs of low-income older adults is even more challenging. At the same time, some programs are restricted only to older adults who qualify as low income and may create gaps in transportation coverage for a growing number of older adults. This disparity is an area that policy makers may need more information about to better understand its scope and magnitude.

### **More Research Is Needed to Understand the True Impact and Efficacy of Future Trends**

Technology is beginning to impact the aging population's access to transportation in the form of advanced vehicle technologies, which may make it safer for older adults to drive longer, and app-based ride services, such as the use of TNCs to fill existing transportation gaps. Moreover, new technological advances will continue to present innovative opportunities to meet the transportation needs of the aging population, though it is too soon to tell how quickly these

innovations will come to fruition or exactly what impact they will have on the mobility needs of older adults. In addition, the growth of some technologies that may make aging in place more realistic, like home delivery apps, may also exacerbate issues of isolation. More research is needed to determine the true impact of these trends and to consider the quality-of-life measures and access to basic necessities.

## **Opportunities for Agencies to Collaborate Could Lead to Increased Mobility for Aging Population**

In addition to programs that provide direct transportation services to the aging population, there is a need for programs that assist local municipalities and organizations in identifying funding sources and applying for grants to fund transportation services for older adults. The National Aging Disability Transportation Center (NADTC) is an example of an organization that provides technical assistance to promote and increase transportation options for older adults and people with disabilities and caregivers. NADTC is funded in partnership by FTA, Easterseals, and the National Association of Area Agencies on Aging. NADTC offers community grants that are designed to help communities assess their transportation needs and develop and implement innovations and new models to increase the availability of accessible transportation services for older adults and people with disabilities. Its services include making effective use of Section 5310 Enhanced Mobility of Seniors and Individuals with Disabilities funds. Grants are awarded through a competitive application process (158).

## **Urban and Rural Areas Will Both Face Mobility Challenges but Require Different Solutions**

In urban areas, public transit systems and other services currently exist but may not be easily accessible to the aging population. As noted earlier, even in cities, many older adults are not within walking distance of existing transit. In these areas, policies can focus on more efficiently utilizing those existing services to account for the needs of the aging population. In rural areas, where non-driving transportation options are limited or nonexistent, new and improved services will be needed. Although many older adults want to remain in their homes in rural areas, it may not be feasible for them to maintain a high quality of life in rural areas if limited options exist. Some older adults may be able to choose to move to locations that are more accessible, but this is not a feasible option for everyone. Finally, the MoNI revealed a high proportional and absolute mobility need in suburban counties that are near urban centers. These areas are within range of existing transit networks and the operating areas of ride services, suggesting a strong potential to efficiently expand transportation options for older adults in these areas for lower marginal costs.

Shared rides services, like TNCs, are an opportunity to close gaps in the accessibility of existing transit networks. These services may expand the reach of transit services in suburban and even rural areas. For example, TNCs can provide a connection to a rail line that may not be walk-accessible for an older adult. Many new travel modes and services are evolving in the market,

and further research could identify barriers, opportunities, and supportive policies that would encourage these services to meet the needs of the aging population.

## References

---

1. Texas Demographic Center. 2014 Texas Population Projections by Migration Scenario Data Tool Result. <http://txsdc.utsa.edu/data/TPEPP/Projections/Report?id=26268a9acb0948758c2a9bdd2fb5e6fb>. Accessed Feb. 10, 2017.
2. Texas State Data Center. Texas Population Estimates. <http://txsdc.utsa.edu/Data/TPEPP/>. Accessed February 1, 2017.
3. Frolik, L. Three States of Old. Cooperative Aging, Mar. 3, 2009. <http://www.cooperativeaging.com/2009/03/three-stages-of-old-age.html>. Accessed Apr. 18, 2017.
4. King, S., and H. Dabelko-Schoeny. “Quite Frankly, I Have Doubts About Remaining”: Aging-In-Place and Health Care Access for Rural Midlife and Older Lesbian, Gay and Bisexual Individuals. *Journal of LGBT Health Research*, Vol. 5, No. 1–2, 2009, pp. 10–21.
5. Fry, R. Millennials Overtake Baby Boomers as America’s Largest Generation. Pew Research Center, Apr. 25, 2016. <http://www.pewresearch.org/fact-tank/2016/04/25/millennials-overtake-baby-boomers/>. Accessed Jan. 24, 2017.
6. Frey, W. Boomers and Seniors in the Suburbs: Aging Patterns in Census 2000. Brookings, Jan. 1, 2003. <https://www.brookings.edu/research/boomers-and-seniors-in-the-suburbs-aging-patterns-in-census-2000/>. Accessed Jan. 24, 2017.
7. Rosenbloom, S. Sustainability and Automobility Among the Elderly: An International Assessment. *Transportation*, Vol. 28, No. 4, 2001, pp. 375–408.
8. Rosenbloom, S., and S. Herbel. The Safety and Mobility Patterns of Older Women: Do Current Patterns Foretell the Future? *Public Works Management & Policy*, Vol. 13, No. 4, 2009, pp. 338–353.
9. National Highway Traffic Safety Administration. Older Population. U.S. Department of Transportation, May 2014. <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812005>. Accessed Feb. 2, 2017.
10. Bergal, J. Can Car-Centric Suburbs Adjust to Aging Baby Boomers? Pew Charitable Trusts, June 20, 2016. <http://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2016/06/20/can-car-centric-suburbs-adjust-to-aging-baby-boomers>. Accessed Jan. 24, 2017.
11. Whelan, M., J. Langford, J. Oxley, S. Koppel, and J. Charlton. *The Elderly and Mobility: A Review of the Literature*. Monash University Accident Research Centre, Victoria, Australia, 2006.

12. DeGood, K., D. Goldberg, N. Donohue, and L. Shoup. *Aging in Place, Stuck without Options: Fixing the Mobility Crisis Threatening the Baby Boom Generation*. Transportation for America, 2011. <http://www.t4america.org/docs/SeniorsMobilityCrisis.pdf>. Accessed Jan. 24, 2017.
  13. Siren, A., S. Haustein, A. Meng, D. Bell, E. Pokriefke, B. Lang, K. F. Medina, C. Gabaude, C. Marin-Lamellte, H. M. I. Bort, and Z. Strnadova. *Driver Licensing Legislation*. European Commission, 2013.
  14. Webb, E., A. Lavery, J. Mindell, and C. Millett. Free Bus Travel and Physical Activity, Gait Speed and Adiposity in the English Longitudinal Study of Ageing. *American Journal of Public Health*, Vol. 106, No. 1, 2016, pp. 136–142.
  15. Oxley, J., and M. Whelan. It Cannot Be All about Safety: The Benefits of Prolonged Mobility. *Traffic Injury Prevention*, Vol. 9, No. 4, 2008, pp. 367–378.
  16. Sullivan, J., J. Sears, and K. Glitman. *A Travel-Livability Index for Seniors, Phase 1: Livability Attribute Importance*. University of Vermont Transportation Research Center, Burlington, 2011.
  17. Kim, S., and G. Ulfarsson. Travel Mode Choice of the Elderly: Effects of Personal, Household, Neighborhood and Trip Characteristics. *Transportation Research Record: Journal of the Transportation Research Board*, No. 1894, Vol. 1, 2004, pp. 117–126.
  18. Suen, S. L., and L. Sen. Mobility Options for Seniors. *Proc., Transportation in an Ageing Society: A Decade of Experience*, Vol. 27, Transportation Research Board, Washington, DC, 2004, pp. 97–113.
  19. Joint Center for Housing Studies of Harvard University. *Housing America's Older Adults—Meeting the Needs of an Aging Population*. 2014. [http://www.jchs.harvard.edu/research/housing\\_americas\\_older\\_adults](http://www.jchs.harvard.edu/research/housing_americas_older_adults). Accessed Apr. 18, 2017.
  20. The Goodman Corporation. Transportation and an Aging Population. Houston-Galveston Area Council, November 8, 2013. <https://www.h-gac.com/community/qualityplaces/workshops/documents/FPWS-11-08-2013-TransportationAndAnAgingPopulation-Webb.pdf>. Accessed Feb. 2, 2017.
  21. Vehicle Technology Preferences. The Hartford. <https://www.thehartford.com/resources/mature-market-excellence/technology-preferences>. Accessed Feb. 2, 2017.
  22. Dye, C. J., D. F. Willoughby, and D. G. Battisto. Advice from Rural Elders: What It Takes to Age in Place. *Educational Gerontology*, Vol. 37, No. 1, 2010, pp. 74–93.
  23. Bailey, L. *Aging Americans: Stranded Without Options*. Surface Transportation Policy Project, Washington, DC, Apr. 2004.
  24. Kerschner, H. *Transportation Innovations for Seniors: A Synopsis of Findings in Rural America*. Community Transportation Association of America, Washington, DC, 2006.
-

25. Federal Transit Administration. Enhanced Mobility of Seniors & Individuals with Disabilities—Section 5310. U.S. Department of Transportation, 2016. <https://www.transit.dot.gov/funding/grants/enhanced-mobility-seniors-individuals-disabilities-section-5310>. Accessed Jan. 11, 2017
26. Federal Transit Administration. Fact Sheet: Enhanced Mobility of Seniors and Individuals with Disabilities. U.S. Department of Transportation. [https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/5310% 20Enhanced %20Mobility% 20of% 20Seniors% 20and% 20Disabled% 20Fact% 20Sheet.pdf](https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/5310%20Enhanced%20Mobility%20of%20Seniors%20and%20Disabled%20Fact%20Sheet.pdf). Accessed Feb. 3, 2017.
27. U.S. Department of Justice. The Americans with Disabilities Act of 1990 and Revised ADA Regulations Implementing Title II and Title III. [https://www.ada.gov/2010\\_regs.htm](https://www.ada.gov/2010_regs.htm). Accessed Jan. 31, 2017.
28. Federal Transit Administration. Americans with Disabilities Act (ADA): Guidance. FTA Circular 4710.1, Nov. 4, 2015. <https://www.transit.dot.gov/node/43561>. Accessed Feb. 1, 2017.
29. Centers for Medicare and Medicaid Services. Medicaid. [https://www.medicaid.gov/medicaid/ index.html](https://www.medicaid.gov/medicaid/index.html). Accessed Jan. 31, 2017.
30. U.S. Department of Health and Human Services. Administration on Aging—Older Americans Act. [https://aoa.acl.gov/AoA\\_Programs/OAA/Index.aspx](https://aoa.acl.gov/AoA_Programs/OAA/Index.aspx). Accessed Jan. 24, 2017.
31. Rosenbloom, B. S. Meeting Transportation Needs in an Aging-Friendly Community. *Communities*, Vol. 33, No. 2, 2009, pp. 33–43.
32. Brewer, M., D. Murillo, and A. Pate. *Handbook for Designing Roadways for the Aging Population*. Federal Highway Administration, Washington, DC, 2014.
33. Office of Highway Policy Information. Highway Statistics 2015: Distribution of Licensed Drivers—2015. FHWA, Sep. 2016. [https://www.fhwa.dot.gov/policyinformation /statistics/2015/dl20.cfm](https://www.fhwa.dot.gov/policyinformation/statistics/2015/dl20.cfm). Accessed Apr. 18, 2017.
34. Rosenbloom, S. *Roadblocks Ahead for Seniors Who Don't Drive*. Urban Institute, May 2013. <http://www.urban.org/sites/default/files/publication/23646/412825-Roadblocks-Ahead-for-Seniors-Who-Don-t-Drive.PDF>. Accessed Oct. 3, 2016.
35. Naumann, R. B., A. M. Dellinger, M. L. Anderson, A. E. Bonomi, F. P. Rivara, and R. S. Thompson. Preferred Modes of Travel among Older Adults: What Factors Affect the Choice to Walk Instead of Drive? *Journal of Safety Research*, Vol. 40, No. 5, 2009, pp. 395–398.

36. Dennis Thomas III, F., R. D. Blomberg, M. Knodler, and M. Romoser. *Licensing Procedures for Older Drivers*. National Highway Traffic Safety Administration, Washington, DC, 2013.
37. Texas Department of Public Safety. Texas Drivers 79 and Older. <https://www.dps.texas.gov/DriverLicense/elderlydrivers.htm>. Accessed Oct. 3, 2016.
38. United States Government Accountability Office. GAO-15-419, Retirement Security: Most Households Approaching Retirement Have Low Savings. 2015. <http://www.gao.gov/assets/680/670153.pdf>. Accessed Oct. 3, 2016.
39. Driver Improvement Courses For Seniors. <http://seniordriving.aaa.com/maintain-mobility-independence/driver-improvement-courses-seniors/>. Accessed February 10, 2017.
40. Texas Department of Transportation (State of Texas). CarFit Offers Senior Drivers a Car Checkup. <http://www.txdot.gov/inside-txdot/media-center/local-news/paris/053-2016.html>. Accessed Feb. 1, 2017.
41. Mature Driver Program. <http://www.sw.org/trauma-center/mature-driver-program>. Accessed February 1, 2017.
42. DeGood, K., D. Goldberg, N. Donohue, and L. Shoup. Aging in Place, Stuck without Options: Fixing the Mobility Crisis Threatening the Baby Boom Generation. Policy, 2011, p. 56.
43. Federal Transit Administration. Circular FTA C 9030.1E, Urbanized Area Formula Program: Program Guidance and Application Instructions. 2014. [https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FINAL\\_FTA\\_circular9030.1E.pdf](https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FINAL_FTA_circular9030.1E.pdf). Accessed May 5, 2017.
44. Cherrington, L., S. Tan, and T. Hansen. *Sources of Funding Transit in Texas*. Texas A&M Transportation Institute Policy Research Center, Austin, Tex., April 2017.
45. Kittelson & Associates. *TCRP Report 165: Transit Capacity and Quality of Service Manual, Third Edition*. Transportation Research Board, Washington, DC, 2013.
46. Zeitler, E., L. Buys, R. Aird, and E. Miller. Mobility and Active Ageing in Suburban Environments: Findings from In-Depth Interviews and Person-Based GPS Tracking. *Current Gerontology and Geriatrics Research*, Vol. 2012. doi:10.1155/2012/257186.
47. Clarke, P., and N. A. Gallagher. Optimizing Mobility in Later Life: The Role of the Urban Built Environment for Older Adults Aging in Place. *Journal of Urban Health*, Vol. 90, No. 6, 2013, pp. 997–1009.
48. *TCRP Report 95: Traveler Response to Transportation System Changes Handbook*, Third Edition: Chapter 12, Transit Pricing and Fares. Transportation Research Board, Washington, DC, 2004.



49. SEPTA. Seniors Ride Transit Free on SEPTA. <http://www.septa.org/fares/discount/seniors-ride-free-info.html>. Accessed Feb. 1, 2017.
50. Seniors and Veterans Fare Pass—Miami-Dade County. <http://www.miamidade.gov/transit/seniors-veterans-fare-programs.asp>. Accessed Feb. 1, 2017.
51. Seniors Ride Free. <https://www.illinois.gov/gov/ridefree/Pages/SeniorsRideFree.aspx>. Accessed Feb. 1, 2017.
52. Capital Metro Transportation Authority. Reduced Fare Program. <https://capmetro.org/rfid/>. Accessed Feb. 1, 2017.
53. Corpus Christi Regional Transportation Authority. Reduced Fare Program. <https://www.ccrtc.org/get-a-pass/fares/>. Accessed Feb. 1, 2017.
54. Dallas Area Rapid Transit. Reduced Fare Program. <http://www.dart.org/fares/fares.asp>. Accessed Jan. 31, 2017.
55. Fort Worth Transportation Authority. Reduced Fare Program. <http://www.fwta.org/fares/reduced-fares/>. Accessed Jan. 31, 2017.
56. Sun Metro. Reduced Fare Program. <http://www.sunmetro.net/fares/reduced-fare>. Accessed Jan. 31, 2017.
57. Houston METRO. Reduced Fare Program. <http://www.ridemetro.org/Pages/FareDiscountedFare.aspx>. Accessed Jan. 31, 2017.
58. El Metro Transit. Reduced Fare Program. <http://elmetrotransit.com/fares/reduced-fare-program/>. Accessed Jan. 31, 2017.
59. Via Transit. Reduced Fare Program. <http://www.viainfo.net/reduced-fares/>. Accessed Jan. 31, 2017.
60. Capital Metropolitan Transportation Authority. Travel Training Brochure. [https://www.capmetro.org/uploadedFiles/Capmetroorg/Riders\\_Guide/Accessible\\_Services/travel-training-brochure.pdf](https://www.capmetro.org/uploadedFiles/Capmetroorg/Riders_Guide/Accessible_Services/travel-training-brochure.pdf). Accessed Jan. 31, 2017.
61. Goodwill, J. A., and H. Carapella. *Creative Ways to Manage Paratransit Costs*. National Center for Transit Research (NCTR) Center for Urban Transportation Research, University of South Florida, 2008.
62. Gupta, D., H.-W. Chen, L. A. Miller, and F. Surya. Improving the Efficiency of Demand-Responsive Paratransit Services. *Transportation Research Part A: Policy and Practice*, Vol. 44, No. 4, 2010, pp. 201–217.
63. United States Government Accountability Office. ADA Paratransit Services: Demand Has Increased, but Little Is Known about Compliance. 2012. <http://www.gao.gov/assets/660/650079.pdf>. Accessed May 8, 2017.



64. Lambert, T. Metropolitan Transit Authority of Harris County, Texas (Metro). Ride Metro, 2014. [https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/60008\\_0.pdf](https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/60008_0.pdf). Accessed May 8, 2017.
65. Delaughter, G. Fares Are About to Go Up for MetroLift Paratransit Service. Houston Public Media, Nov. 18, 2015. <http://www.houstonpublicmedia.org/articles/news/2015/11/18/127958/fares-are-about-to-go-up-for-metrolift-paratransit-service/>. Accessed May 8, 2017.
66. Begley, D. Houston Looks to Ease Mass Transit Woes for the Disabled. *Houston Chronicle*, April 10, 2017. <http://www.houstonchronicle.com/news/texas/article/Houston-looks-to-ease-mass-transit-woes-for-the-11062640.php>. Accessed May 8, 2017.
67. Drive a Senior. Our Mission: Seniors Living Independently. <https://www.volunteerdriving.com/missionhistory/>. Accessed Jan. 20, 2017.
68. Arndt, J. C., and L. K. Cherrington. *The Role of Private-For-Hire Vehicles in Transit in Texas*. Report FHWA/TX-07/0-5545-1. Texas Transportation Institute, College Station, Tex., 2007. <https://static.tti.tamu.edu/tti.tamu.edu/documents/0-5545-1.pdf>. Accessed May 8, 2017.
69. METRO. METRO Home. <http://www.ridemetro.org/Pages/MLOtherPrograms.aspx>. Accessed May 8, 2017.
70. What is RIDES? Harris County RIDES. <http://www.harriscountyrides.com/index.php>. Accessed May 8, 2017.
71. Kane, J., A. Tomer, and R. Puentes. How Lyft and Uber Can Improve Transit Agency Budgets. Brookings Institution, Mar. 8, 2016. <https://www.brookings.edu/research/how-lyft-and-uber-can-improve-transit-agency-budgets/>. Accessed May 8, 2017.
72. Hosen, K. I., and E. Fetting. *TCRP Synthesis 65: Transit Agency Participation in Medicaid Transportation Programs*. Transportation Research Board, Washington, DC, 2006. <http://www.tcrponline.org/PDFDocuments/tsyn65.pdf>. Accessed May 9, 2017.
73. Myers, A. Non-emergency Medical Transportation: A Vital Lifeline for a Healthy Community. National Conference of State Legislatures, Jan. 7, 2015. <http://www.ncsl.org/research/transportation/non-emergency-medical-transportation-a-vital-lifeline-for-a-healthy-community.aspx>. Accessed May 9, 2017.
74. Cherrington, L., and S. Edrington. *TCRP Report B-44: Examining the Effects of Separate Non-emergency Medical Transportation (NEMT) Brokerages on Transportation Coordination*. Transportation Research Board, Washington, DC, 2015. [https://tti.tamu.edu/group/transit-mobility/files/2015/11/Appendix-B-State-By-State-Profiles-1\\_5\\_15.pdf](https://tti.tamu.edu/group/transit-mobility/files/2015/11/Appendix-B-State-By-State-Profiles-1_5_15.pdf). Accessed May 9, 2017.

75. Ngo, D. *State of Texas Medical Transportation Program Rate Setting State Fiscal Year 2015*. Texas Health and Human Services Commission, Austin, Texas, 2014. <http://legacy-hhsc.hhsc.state.tx.us/rad/managed-care/downloads/2015-01-mtp.pdf>. Accessed May 9, 2017.
  76. Project Amistad. About Us. [www.projectamistad.org](http://www.projectamistad.org). Accessed Mar. 5, 2017.
  77. Project Amistad. *2016 Annual Report*. <https://static1.squarespace.com/static/55a193bae4b085889082f45b/t/58a62c263a041180c4e743fa/1487285299147/2016+Annual+Report+Online+Version.pdf>. Accessed Mar. 7, 2017.
  78. Welch, K. New Firm to Take Over Medicaid Transportation. *Amarillo Globe-News*, July 20, 2016. <http://amarillo.com/news/local-news/2014-08-27/new-firm-take-over-medicaid-transportation-panhandle>. Accessed Mar. 9, 2017.
  79. LeFleur Transportation. Texas Non-emergency Medical Transportation. <http://www.lefleur.net/texas>. Accessed Mar. 5, 2017.
  80. Legislative Budget Board Staff. *Improve the Cost-Effectiveness of Medical Transportation Services for Texas Medicaid Clients*. Texas Legislative Budget Board Staff Reports, Austin, Tex., 2017. <https://assets.documentcloud.org/documents/3458673/Medical-Transport-Program-Report-From-LBB.pdf>. Accessed Mar. 9, 2017.
  81. Kerschner, H. Volunteer Driver Programs. National Volunteer Transportation Center, 2015. <http://www.giaging.org/issues/volunteer-driver-programs>. Accessed Mar. 5, 2017.
  82. Faith in Action. Robert Wood Johnson Foundation, 2005. [http://www.rwjf.org/content/dam/farm/reports/program\\_results\\_reports/2009/rwjf69788](http://www.rwjf.org/content/dam/farm/reports/program_results_reports/2009/rwjf69788). Accessed Mar. 5, 2017.
  83. ITN America. ITN Affiliated Communities. <http://www.itnamerica.org/find-your-affiliate>. Accessed Jan. 20, 2017.
  84. Faith in Action Georgetown. Home. <http://www.faithinactiongt.org/>. Accessed May 9, 2017.
  85. Senior Rides and More. Transportation. <http://www.seniorridesandmore.org/transportation.html>. Accessed May 9, 2017.
  86. Koffman, D., R. Weiner, A. Pfeiffer, and S. Chapman. *Funding the Public Transportation Needs of an Aging Population*. American Public Transportation Association, Mar. 2010. [http://www.apta.com/resources/reportsandpublications/Documents/TCRP\\_J11\\_Funding\\_Transit\\_Needs\\_of\\_Aging\\_Population.pdf](http://www.apta.com/resources/reportsandpublications/Documents/TCRP_J11_Funding_Transit_Needs_of_Aging_Population.pdf). Accessed May 8, 2017.
  87. National Center on Senior Transportation. Taxis for Senior Transportation. AARP, 2011. <http://www.aarp.org/content/dam/aarp/livable-communities/old-learn/transportation/taxis-for-senior-transportation-aarp.pdf>. Accessed May 8, 2017.
-

88. Department of Health and Human Services Aging and Disability Services Division. Taxi Assistance Program. [http://adsd.nv.gov/Programs/Seniors/TAP/TAP\\_Prog](http://adsd.nv.gov/Programs/Seniors/TAP/TAP_Prog). Accessed Feb. 2, 2017.
89. New Solutions to Keep Seniors Moving. Lyft, 2016. <https://blog.lyft.com/posts/new-solutions-to-keep-seniors-moving>. Accessed Jan. 31, 2017.
90. Piloting UberACCESS in Houston. Uber, Apr. 13, 2016. <https://newsroom.uber.com/us-texas/piloting-uberaccess-in-houston/>. Accessed May 8, 2017.
91. Begley, D. Disabled Gain Access to Uber Rides. *Houston Chronicle*, Apr. 13, 2016. <http://www.chron.com/news/transportation/article/Disabled-gain-access-with-Uber-pilot-7244375.php>. Accessed May 8, 2017.
92. Poon, L. How an Uber Copycat Can Fill the Transit Gap in Rural Nebraska. Atlantic City Lab, July 12, 2016. [86www.citylab.com/navigator/2016/07/how-an-uber-copycat-can-fill-the-transportation-gap-in-rural-nebraska/490769/](http://www.citylab.com/navigator/2016/07/how-an-uber-copycat-can-fill-the-transportation-gap-in-rural-nebraska/490769/). Accessed Feb. 2, 2017.
93. Liberty Mobility Now. About Us. <http://libertymobilitynow.com/>. Accessed May 8, 2017.
94. 2016 Transportation Trends: A Look at the Year's Top Mobility Challenges & Opportunities. National Aging and Disability Transportation Center, 2017. <http://www.nadtc.org/wp-content/uploads/NADTC-Trends-Report-Mar-2017-FINAL.pdf>. Accessed May 8, 2017.
95. Ferenstein, G. The Evolution of Uber Leads to Lift Hero, Ridesharing for the Elderly. Venture Beat Business, Oct. 8, 2014. <http://venturebeat.com/2014/10/08/the-evolution-of-uber-leads-to-lift-hero-ridesharing-for-the-elderly/>. Accessed February 2, 2017.
96. GoGoGrandparent. Home. <https://gogograndparent.com/>. Accessed May 8, 2017.
97. Lien, T. Lyft and Uber Launch Programs to Cater to Seniors. *LA Times*, Aug. 30, 2016. <http://www.latimes.com/business/technology/la-fi-tn-lyft-uber-seniors-20160829-snap-story.html>. Accessed May 8, 2017.
98. Fierro, W. Uber, Lyft Expand to Senior Market. Commercial Hirecar Insurance Company, Oct. 16, 2016. <https://chicinsurance.com/news/64-uber-lyft-expand-to-senior-market>. Accessed May 8, 2017.
99. GreatCall and Lyft Solve Transportation Issues for Seniors Using Personal Operators. GreatCall, Aug. 30, 2016. <https://www.greatcall.com/newsroom/press-releases/2016/greatcall-and-lyft-solve-transportation-issues-for-seniors-using-personal-operators>. Accessed May 8, 2017.
100. Ride With 24. Home. [www.ridewith24.com/](http://www.ridewith24.com/). Accessed May 8, 2017.
101. Rosenbloom, S. Mobility of the Elderly. *Proc., Transportation in an Aging Society: A Decade of Experience*, Vol. 27. Transportation Research Board, Washington, DC, 2004.

102. Staplin, L., and L. Hunt. Driver Programs. *Proc., Transportation in an Aging Society: A Decade of Experience*, Vol. 27. Transportation Research Board, Washington, DC, 2004.
103. Cobb, R. W., and J. F. Coughlin. Transportation Policy for an Aging Society: Keeping Older Americans on the Move. *Proc., Transportation in an Aging Society: A Decade of Experience*, Vol. 27. Transportation Research Board, Washington, DC, 2004.
104. Kim, S. Assessing Mobility in an Aging Society: Personal and Built Environment Factors Associated with Older People's Subjective Transportation Deficiency in the US. *Transportation Research Part F: Traffic Psychology and Behaviour*, Vol. 14, No. 5, 2011, pp. 422–429.
105. Golden, M., D. Chia, B. Ellis, and R. Thatcher. *Accessible Transit Services for All*. Federal Transit Administration, 2014. [https://ntl.bts.gov/lib/55000/55500/55563/FTA\\_Report\\_No.\\_0081.pdf](https://ntl.bts.gov/lib/55000/55500/55563/FTA_Report_No._0081.pdf). Accessed May 8, 2017.
106. Transportation Options for Older Adults. Choices for Mobility Independence, 2016. [http://www.eldercare.gov/eldercare.net/public/Resources/Brochures/docs/Trans\\_Options\\_Panels.pdf](http://www.eldercare.gov/eldercare.net/public/Resources/Brochures/docs/Trans_Options_Panels.pdf). Accessed May 8, 2017.
107. Clarke, P., J. A. Ailshire, and P. Lantz. Urban Built Environments and Trajectories of Mobility Disability: Findings from a National Sample of Community-Dwelling American Adults (1986–2001). *Social Science and Medicine*, Vol. 69, No. 6, 2009, pp. 964–970.
108. Lee, J. S., P. C. Zengras, and E. Ben-Joseph. Safely Active Mobility for Urban Baby Boomers: The Role of Neighborhood Design. *Accident Analysis and Prevention*, Vol. 61, 2013, pp. 153–166.
109. Lynott, J., and C. Figueiredo. *How the Travel Patterns of Older Adults Are Changing: Highlights from the 2009 National Household Travel Survey*. AARP Public Policy Institute, 2011. <http://assets.aarp.org/rgcenter/ppi/liv-com/fs218-transportation.pdf>. Accessed Apr. 18, 2017.
110. Wennberg, H., C. Hydén, and A. Ståhl. Barrier-Free Outdoor Environments: Older Peoples' Perceptions before and after Implementation of Legislative Directives. *Transport Policy*, Vol. 17, No. 6, 2010, pp. 464–474.
111. Moniruzzaman, M., and A. Páez. An Investigation of the Attributes of Walkable Environments from the Perspective of Seniors in Montreal. *Journal of Transport Geography*, Vol. 51, 2016, pp. 85–96.
112. Burden, C. D. Community Design: The Next Step to an Active Society? *Journal on Active Aging*, Vol. 3, No. 1, 2004, pp. 24–30.

113. Nathan, A., G. Pereira, S. Foster, P. Hooper, D. Saarloos, and B. Giles-Corti. Access to Commercial Destinations within the Neighbourhood and Walking among Australian Older Adults. *The International Journal of Behavioral Nutrition and Physical Activity*, Vol. 9, No. 1, 2012, p. 133.
114. Ceccato, V., and R. Bamzar. Elderly Victimization and Fear of Crime in Public Spaces. *International Criminal Justice Review*, Vol. 26, No. 2, 2016, pp. 115–133.
115. Levi, S., D. M. De Leonardis, J. Antin, and L. Angel. *Identifying Countermeasure Strategies to Increase Safety of Older Pedestrians*. Office of Behavioral Safety Research, National Highway Traffic Safety Administration, Washington, DC, 2013.
116. The Pedestrian Safety Workshop: A Focus on Older Adults. National Highway Traffic Safety Administration and the University of North Carolina Highway Safety Research Center, 2010. <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/pedsafetyworkshop-02.pdf>. Accessed Dec. 15, 2016.
117. Perez, A., A. Garces, R. H. Hunter, and D. X. Marquez. An Audit of a Diverse Community for Safe Routes to Age in Place: Environmental Policy Implications. *Journal of Gerontological Nursing*, Vol. 41, No. 3, 2015, pp. 13–21.
118. Texas Health and Human Services. Walk Texas! Department of State Health Services, Jan. 14, 2011. <https://www.dshs.texas.gov/diabetes/walktx.shtm>. Accessed May 31, 2017.
119. Portland Bureau of Transportation. Senior Cyclist Program—Biking is Back! <https://www.portlandoregon.gov/transportation/article/155167>. Accessed May 31, 2017.
120. U.S. Department of Health and Human Services. Administration on Aging—Older Americans Act. [https://aoa.acl.gov/AoA\\_Programs/OAA/Index.aspx](https://aoa.acl.gov/AoA_Programs/OAA/Index.aspx). Accessed Jan. 24, 2017.
121. National Center on Senior Transportation. *Transportation: A Silent Need*. 2010. [https://www.n4a.org/files/Transportation\\_TheSilentNeed.pdf](https://www.n4a.org/files/Transportation_TheSilentNeed.pdf). Accessed Jan. 24, 2017.
122. Robinson, K., J. Lucado, C. Schur, and Social & Scientific Systems Inc. Use of Transportation Services among OAA Title III Program Participants. Sep. 2012. [https://aoa.acl.gov/Program\\_Results/docs/2012/AoA\\_6th\\_xation\\_Brief\\_Oct\\_2012.pdf](https://aoa.acl.gov/Program_Results/docs/2012/AoA_6th_xation_Brief_Oct_2012.pdf). Accessed Jan. 31, 2017.
123. National Association of Area Agencies on Aging. Local Leaders in Aging and Community Living. <http://www.n4a.org/files/LocalLeadersAAA.pdf>. Accessed Feb. 1, 2017.
124. Texas Association of Regional Councils. Area Agencies on Aging. <http://txregionalcouncil.org/regional-programs/health-and-human-services/area-agencies-on-aging/>. Accessed Apr. 28, 2017.

125. Texas Administrative Code. Title 40, Part 1, Chapter 83, Rule §83.3: Social Services and Assistance Department of Aging and Disability Services Areas Agency on Aging Administrative Requirements. [http://texreg.sos.state.tx.us/public/readtac\\$ext.TacPage?sl=R&app=9&p\\_dir=&p\\_rloc=&p\\_tloc=&p\\_ploc=&pg=1&p\\_tac=&ti=40&pt=1&ch=83&rl=http://texreg.sos.state.tx.us/public/readtac\\$ext.TacPage?sl=R&app=9&p\\_dir=&p\\_rloc=&p\\_tloc=&p\\_ploc=&pg=1&p\\_tac=&ti=40&pt=1&ch=83&rl=3](http://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=40&pt=1&ch=83&rl=http://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=40&pt=1&ch=83&rl=3). Accessed Mar. 19, 2017.
126. Texas Administrative Code. Title 40, Part 1, Chapter 85, Subchapter D, Rule §85.301: Social Services and Assistance Department of Aging and Disability Services Implementation of the Older Americans Act Older Americans Act Services. [http://texreg.sos.state.tx.us/public/readtac\\$ext.TacPage?sl=T&app=9&p\\_dir=N&p\\_rloc=138019&p\\_tloc=&p\\_ploc=1&pg=3&p\\_tac=&ti=40&pt=1&ch=85&rl=206](http://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=T&app=9&p_dir=N&p_rloc=138019&p_tloc=&p_ploc=1&pg=3&p_tac=&ti=40&pt=1&ch=85&rl=206). Accessed Mar. 19, 2017.
127. East Texas Council of Governments. Aging Services. <http://www.etcog.org/207/Area-Agency-on-Aging.htm>. Accessed May 31, 2017.
128. Panhandle Regional Planning Commission. Welcome. <http://www.theprpc.org/>. Accessed Apr. 28, 2017.
129. Panhandle Regional Planning Commission. 2015–2016 Area Plan. <http://www.theprpc.org/Programs/Aging/FY2015-2016AreaPlan.pdf>. Accessed Apr. 28, 2017.
130. Panhandle Regional Planning Commission. 2017 Strategic Work Program and Budget. 2016. [https://issuu.com/theprpc.org/docs/2017\\_budget](https://issuu.com/theprpc.org/docs/2017_budget). Accessed Apr. 28, 2017.
131. Community Council of Greater Dallas. Dallas Area Agency on Aging. <https://www.ccadvance.org/dallas-area-agency-on-aging/>. Accessed Apr. 28, 2017.
132. Community Council of Greater Dallas. My Ride Dallas. <http://www.ccgd.org/seniors/transportation.html>. Accessed Apr. 28, 2017.
133. Community Council of Greater Dallas. My Ride Home. <https://www.ccadvance.org/my-ride-dallas/>. Accessed May 3, 2017.
134. Alamo Area Council of Governments. Bexar Area Agency on Aging. <http://www.aacog.com/108/Bexar-Area-Agency-on-Aging>. Accessed Feb. 10, 2017.
135. George Washington University. Aging Programs Best Practices. <https://cahh.gwu.edu/aging-programs-best-practices>. Accessed Jan. 31, 2017.
136. National Association of Area Agencies on Aging. Aging Innovations & Achievement Awards. 2016. <http://www.n4a.org/Files/2016AwardsBookFinal.pdf>. Accessed Feb. 1, 2017.



137. National Association of Area Agencies on Aging. Trends and New Directions: Area Agencies on Aging Survey. 2014.  
<https://www.n4a.org/files/AAA%202014%20Survey.pdf>. Accessed Feb. 1, 2017.
138. Texas Health and Human Services. AAAs and Sam's Clubs. <https://stg.hhsc.texas.gov/about-hhs/community-engagement/age-well-live-well/aaas-sams-clubs>. Accessed Feb. 1, 2017.
139. Texas Health and Human Services. Age Well Live Well Resources.  
<https://hhs.texas.gov/sites/hhs/files/documents/about-hhs/community-engagement/awlw/awlw-resource-sheet.pdf>. Accessed Feb. 1, 2017.
140. American Community Survey (ACS) Data. Population Counts.  
<https://www.census.gov/programs-surveys/acs/>.
141. Texas Demographic Center. Demographic Characteristics and Trends in Texas and the San Antonio Area. May 16, 2017. [http://demographics.texas.gov/Resources/Presentations/OSD/2017/2017\\_05\\_16\\_USNavalAcademyAlumniAssociation.pdf](http://demographics.texas.gov/Resources/Presentations/OSD/2017/2017_05_16_USNavalAcademyAlumniAssociation.pdf). Accessed June 1, 2017.
142. Stepler, R. Smaller Share of Women Ages 65 and Older Are Living Alone: More Are Living with Spouse or Children. Pew Research Center, Feb. 18, 2016.  
[http://www.pewsocialtrends.org/files/2016/02/ST\\_2016-02-18\\_older-adult-FINAL.pdf](http://www.pewsocialtrends.org/files/2016/02/ST_2016-02-18_older-adult-FINAL.pdf). Accessed Mar. 23, 2016.
143. Bookman, A. Innovative Models of Aging in Place: Transforming Our Communities for an Aging Population. *Community, Work & Family*, Vol. 11, No. 4, 2008, pp. 419–438.
144. City of New York. New York City Pedestrian Information. <http://www.nyc.gov/html/dot/html/pedestrians/safeseniors.shtml>. Accessed Feb. 1, 2017.
145. Simek, C., and T. Geiselbrecht. *2016 Texas Transportation Poll Final Report*. Texas A&M Transportation Institute, College Station, Tex., Dec. 2016. <https://static.tti.tamu.edu/tti.tamu.edu/documents/PRC-16-16-F.pdf>. Accessed June 1, 2017.
146. Eby, D. W., L. J. Molnar, L. Zhang, R. M. S. Louis, N. Zanier, L. P. Kostyniuk, and S. Stanciu. Use, Perceptions and Benefits of Automotive Technologies among Aging Drivers. *Injury Epidemiology*, Vol. 3, No. 1, 2016.
147. Yang, J., and J. F. Coughlin. In-Vehicle Technology for Self-Driving Cars: Advantages and Challenges for Aging Drivers. *International Journal of Automotive Technology*, Vol. 15, No. 2, 2014, pp. 333–340.
148. Eby, D. W., and L. J. Molnar. Has the Time Come for an Older Driver Vehicle? *Journal of Ergonomics*, Vol. 01, No. s3, 2013.
149. Eby, D. W., L. J. Molnar, L. Zhang, R. M. St Louis, N. Zanier, and L. P. Kostyniuk. *Keeping Older Adults Driving Safely: A Research Synthesis of Advanced In-Vehicle Technologies—A LongROAD Study*. AAA Foundation, Washington, DC, 2015.



150. Davidse, R. J. Older Drivers and ADAS: Which Systems Improve Road Safety? *IATSS Research*, Vol. 30, No. 1, 2006, pp. 6–20.
151. Trübswetter, N., and K. Bengler. Why Should I Use ADAS? Advanced Driver Assistance System and the Elderly: Knowledge, Experience and Usage Barriers. *Proc., Seventh International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design*, 2013, pp. 495–501.
152. Horrigan, J. Online Shopping. Pew Internet & American Life Project, Feb. 13, 2008. [http://www.pewinternet.org/files/old-media//Files/Reports/2008/PIP\\_Online%20Shopping.pdf.pdf](http://www.pewinternet.org/files/old-media//Files/Reports/2008/PIP_Online%20Shopping.pdf.pdf). Accessed Feb. 1, 2017.
153. Abrams, L. How Home Food Delivery for the Elderly Strengthens Communities. *The Atlantic*, Dec. 12, 2012. <https://www.theatlantic.com/health/archive/2012/12/how-home-food-delivery-for-the-elderly-strengthens-communities/265997/>. Accessed Feb. 1, 2017.
154. Meals on Wheels America. Meals on Wheels America Funding—Know the Facts: How Cuts to Federal Funding Would Affect Meals on Wheels. May 2017. <http://www.mealsonwheelsamerica.org/docs/default-source/advocacy/mow-federal-funding-impact-infographic---may-2017.pdf?sfvrsn=2>. Accessed June 1, 2017.
155. Anderson, M. Technology Device Ownership: 2015. Pew Research Center, Oct. 29, 2015. <http://www.pewinternet.org/2015/10/29/the-demographics-of-device-ownership/>. Accessed Mar. 28, 2016.
156. Smith, A. Older Adults and Technology Use—Usage and Adoption. Pew Research Center, Apr. 3, 2014. <http://www.pewinternet.org/2014/04/03/usage-and-adoption/>. Accessed Mar. 23, 2016.
157. Koffman, D., Weiner, R., Pfeiffer, A., and Chapman, S. *Funding the Transportation Needs of an Aging Population*. American Public Transportation Association, Washington, DC, 2010. [http://www.apta.com/resources/reportsandpublications/Documents/TCRP\\_J11\\_Funding\\_Transit\\_Needs\\_of\\_Aging\\_Population.pdf](http://www.apta.com/resources/reportsandpublications/Documents/TCRP_J11_Funding_Transit_Needs_of_Aging_Population.pdf). Accessed May 1, 2017.
158. Improving Access to Transportation for Older Adults and People with Disabilities. National Aging and Disability Transportation Center, Washington, DC, 2016. [http://www.nadtc.org/wp-content/uploads/NADTC\\_Brochure\\_Web\\_Pages.pdf](http://www.nadtc.org/wp-content/uploads/NADTC_Brochure_Web_Pages.pdf). Accessed Feb. 2, 2017.

## Appendix

---

### Mobility Need Index

The MoNI is a score that highlights higher levels of dependency on public transportation on a geographic (county) level. The score is composed of 2015 ACS 5-Year Estimate data (1, 2, 3, 4). Table A-9 displays the categories used to form the MoNI.

**Table A-9. ACS Categories Used for the MoNI.**

| Category          | Description                                                                                                                                  |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Ages 65–74        | This age category is from Table S0101.                                                                                                       |
| Ages 75–84        | This age category is from Table S0101.                                                                                                       |
| Ages 85 and Over  | This age category is from Table S0101.                                                                                                       |
| Poverty Status    | This number represents the percentage of persons 65 and older from all persons for whom poverty status is determined. Data from Table S1701. |
| Disability Status | This number represents the percentage of all persons 65 and older who report a disability status. Data from Table B18101.                    |
| No-Car Households | This number presents the percentage of 65 and over households that do not have any vehicles. Data from Table B25045.                         |

Source: (1, 2, 3, 4)

#### *Index Methodology*

The MoNI is intended to highlight areas of high need for older adults (65 and older). Researchers chose categories highlighted in existing literature that point to higher dependence and need for transportation options. These include persons living in poverty, with a disability, and with no available vehicle. Researchers used the U.S. Census American Fact Finder to download ACS category tables at the county level. These were then tabulated and joined to the 2015 TIGER county shapefile to geographically represent the data.

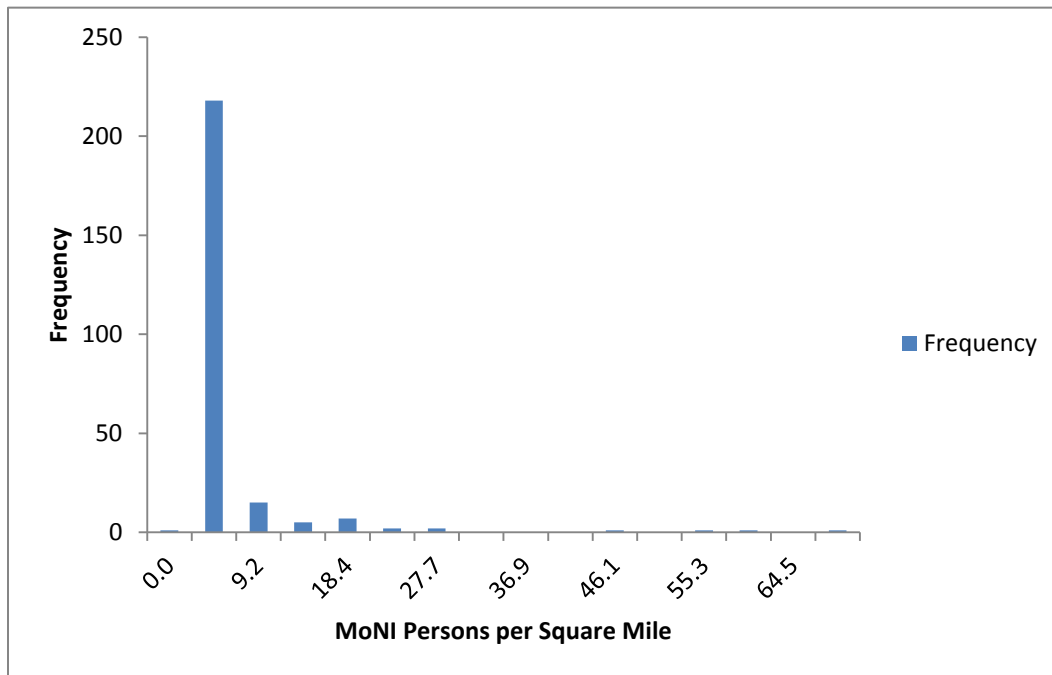
#### *Variable Normalization*

Researchers isolated 65 and older subgroups out of each of these categories to show a total number of older adults within each category. These numbers are geographically constrained within counties. To normalize category numbers, researchers used county land areas to create a persons-per-square-mile measure for all variables.

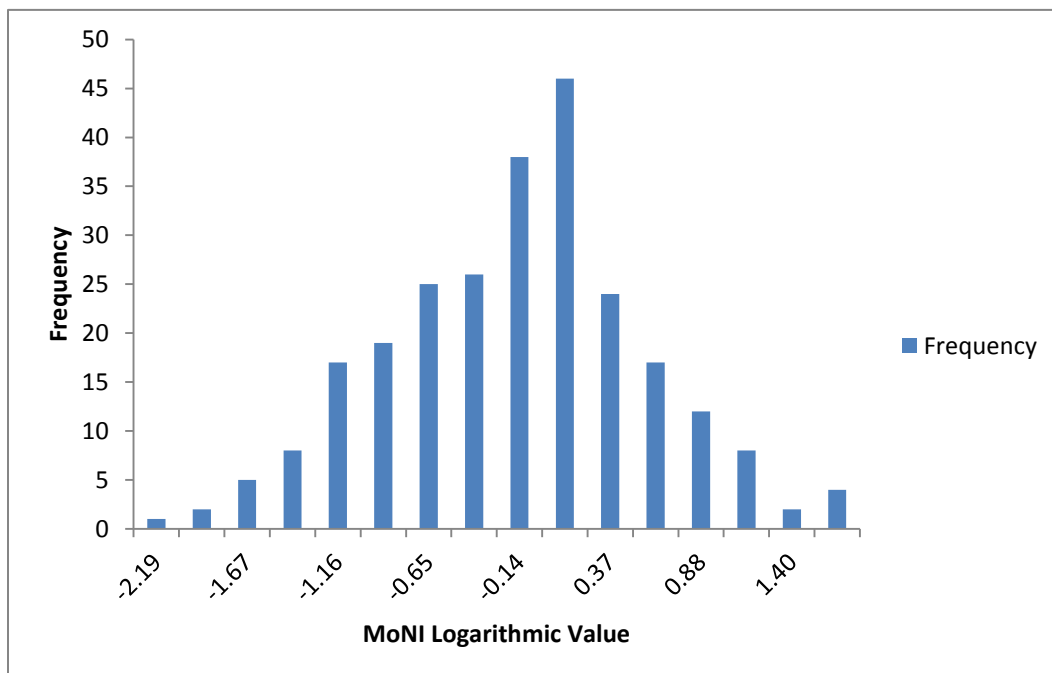
#### *Logarithmic Transformation*

Researchers observed the average of each variable's persons-per-square-mile measure and noticed a highly skewed value toward counties with less population density. Figure A-11 shows this distribution. To produce a more normal distribution, researchers used a logarithmic transformation of base-10. This produced a more normal distribution along with smaller values.

Figure A-12 shows the distribution of the logarithmic values. These values were then weighted to emphasize certain categories.



**Figure A-11. Skewed Distribution of Population Density of the MoNI.**



**Figure A-12. Logarithmic Distribution of the MoNI.**

### *Variable Weighting*

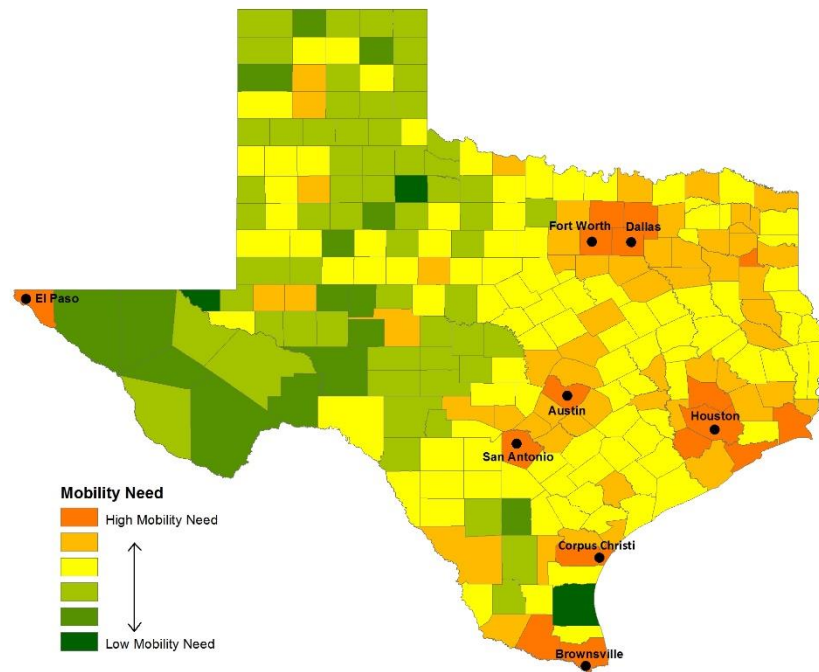
Researchers weighted factors for emphasis while tabulating the MoNI. The highest age group of 85 and older had a weight of 1.5. Other specific variables such as persons 65 and older living in poverty, with no vehicle, and with a disability were given a weight of 1.5. The 75–84 age category had a weight of 1, and the 65–74 age category had a weight of 0.5. The weights were distributed as  $X_w/7.5$  multiplied by each variable's logarithmic value. These weighted variables were combined to produce a MoNI variable. Table A-10 provides a summary of the category weights.

**Table A-10. Category Weights.**

| <b>Category</b>                            | <b>Weight</b> |
|--------------------------------------------|---------------|
| Age 65–74                                  | 0.5           |
| Age 75–84                                  | 1             |
| Age 85 and over                            | 1.5           |
| Persons living in poverty age 65 and over  | 1.5           |
| Households with no vehicle age 65 and over | 1.5           |
| Persons with a disability age 65 and over  | 1.5           |

### *MoNI Score*

The sum of the weighted variables produced the scores used to display the MoNI. The logarithmic transformation helped to show a more varied score across all counties in Texas. Figure A-13 provides a map of all MoNI scores for each county in Texas.



**Figure A-13. MoNI Map.**

## References

1. United States Census Bureau. 2011–2015 American Community Survey 5-Year Estimates: Table S0101: Age and Sex. American FactFinder, 2015. <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>. Accessed May 2, 2017.
2. United States Census Bureau. 2011–2015 American Community Survey 5-Year Estimates: Table S1701: Poverty Status in Past 12 Months. American FactFinder, 2015. <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>. Accessed May 2, 2017.
3. United States Census Bureau. 2011–2015 American Community Survey 5-Year Estimates: Table B18101: Sex by Age by Disability Status. American FactFinder, 2015. [https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS\\_15\\_5YR\\_B18101&prodType=table](https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_5YR_B18101&prodType=table). Accessed May 2, 2017.
4. United States Census Bureau. 2011–2015 American Community Survey 5-Year Estimates: Table B25045: Tenure by Vehicles Available by Age of Householder. American FactFinder, 2015. [https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS\\_15\\_5YR\\_B25045&prodType=table](https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_5YR_B25045&prodType=table). Accessed May 2, 2017.