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GRADUATE COLLEGE

IDENTIFYING PREFERRED NEIGHBORHOOD ATTRIBUTES AMONG INDIVIDUALS 50 YEARS AND OLDER, AND ANALYZING THEIR ACCESS TO THE PHYSICAL ENVIRONMENT: A CASE STUDY ON AGE FRIENDLINESS OF NORMAN, OKLAHOMA

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IDENTIFYING PREFERRED NEIGHBORHOOD ATTRIBUTES AMONG INDIVIDULAS 50 YEARS AND OLDER, AND ANALYZING THEIR ACCESS TO THE PHYSICAL ENVIRONMENT: A CASE STUDY ON AGE FRIENDLINESS OF NORMAN, OKLAHOMA

A DISSERTATION APPROVED FOR THE
CHRISTOPHER C. GIBBS COLLEGE OF ARCHITECTURE

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This Dissertation is dedicated to my husband, sons, parents, and brothers.

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ABSTRACT

The number of people aged 65-and-older has been growing worldwide and in the United States. The needs of these aging individuals will affect the communities in which they live. Faced with this drastic shift in the older adults population, the idea of aging in place was proposed by the World Health Organization (WHO) to focus on making the older adults' homes and communities safe by tailoring them to their well-being and needs. By aging in place, older individuals can remain in communities for as long as possible while keeping their autonomy and social connections.

The concept of aging-in-place has been studied thoroughly in different fields like gerontology, social policy, and public health. By integrating a planning perspective on this interdisciplinary research topic, this dissertation focuses on the neighborhood preferences of individuals aged 50 or older in Norman, Oklahoma as well as their access to age friendly amenities through conducting a survey and spatial analysis. Successful aging in communities is not possible without access to reliable transportation, health services, recreational opportunities, physical and social support systems, and a wide variety of amenities. However, this study's findings demonstrate that currently there is a gap between what individuals 50 years and above need to age in their neighborhoods and the current built environment attributes. Understanding this gap and the challenges these individuals face to age in their communities could help planners and designers develop policy and design recommendations to improve age friendliness of neighborhoods.

Keywords: Age friendliness, Aging in Place, Residential Location Choice, Built Environment Attributes, Spatial Analysis, Older Adults, Middle Aged Adults

Chapter 1: Introduction

Background and Significance of the Study

The rapid growth in the number of seniors in the United States is unprecedented in the nation's history. In 2020 census data revealed that the older population increased from 4.9 million in 1920 to 55.8 million in 2020. This indicates a growth rate of almost five times that of the total population. In 1920 less than 1 in 20 people in the United States were age 65 and over. This proportion increased to 1 in 6 in 2020 or 16.8 Percent of the American population. This rapid growth was mainly due to aging baby boomers born between 1946 and 1964. Beginning 2030, all baby boomers will be 65 years or older which increases the size of the older population to one in every five Americans (Vespa, Medina, and Armstrong 2020).

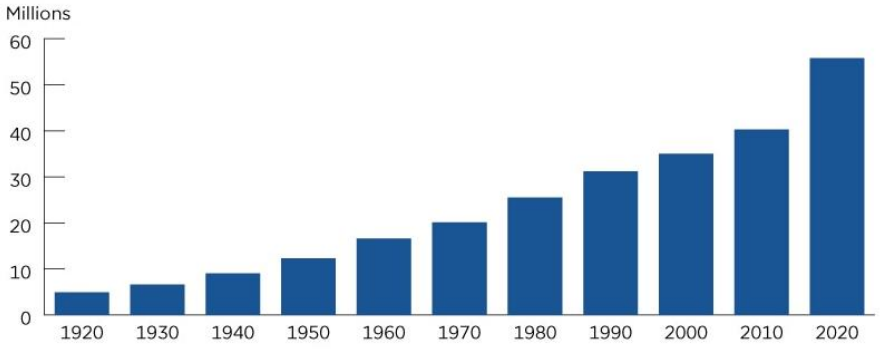

Figure 1: Population 65 years and over, 1920- 2020. Source 2020 U.S. Census Bureau

This issue is not limited to the United States. It has been identified that the world's senior population is increasing quickly. In general health has improved, life expectancy has increased, and people are living longer worldwide. Many individuals are expected to live into their sixties and beyond. By 2030 1 out of 6 individuals in the world will be aged 60 or older and their population will double by 2050 (Erbas 2006; Miller and Annesley 2011; Cutler, Ghosh, and Landrum 2013; Verma 2014; World Health Organization 2023b). The increase in life

expectancy, resulting growth of the elderly population, and needs of the great number of aging people will affect the communities in which they live. Thereby, researchers have focused on various biological, psychological, sociological, and economic aspects of aging (Erbas 2006; Ancora et al. 2022). In the realms of design and planning, experts have been trying to find new ways to ensure that older people are celebrated, welcomed, and have their practical ongoing needs met in their communities (Bayer and Harper 2000; Demirkan 2007; Judd et al. 2010; Dijk et al. 2015; Meeks 2022).

A key and guiding strategy in addressing and meeting the needs of the older population is the concept of Aging-in-place (Bayer and Harper 2000; Judd et al. 2010; Demirkan 2007; Iecovich 2014). The term aging in place has been defined as: '... remaining living at home in the community, with some level of independence, rather than in residential care' (Davey et al. 2004: 133). Aging in a familiar and safe environment leads to various emotional and psychological advantages for older individuals. Providing them with control over their lives, enabling them to keep their identity, and improving their well-being are the reasons for which older individuals prefer to age in a familiar place surrounded by family and friends (Cutchin 2004; Rantz et al. 2005; Farber et al. 2011; Baker et al. 2014).

A study done by Herzog and House (1991) showed that living independently increases life satisfaction, health, and self-esteem which are three keys to aging successfully. On the contrary, relocation causes loss of independence and social relationships, loneliness, adjustment difficulties, emotional stress, changes in daily routines and lifestyles, and overall decline in physical and psychological functioning in older adults (Staveley 1998; Dobbs-Kepper et al. 2001; Iecovich 2014).

Aging in place is not only beneficial from the perspective of older individuals. Policy makers argue that the provision of care in the community and at the older individual's home is much less expensive than institutional care (Chappell et al. 2004; Kaye, LaPlante, and Harrington 2009). Due to high costs of nursing home care for the public sector, many policy makers and professionals in aging societies have endorsed policies that prioritize aging in place (Iecovich 2014). Sociologists and environmental gerontologists have argued that as people become older their attachment to the environment where they live increases (M. Powell Lawton 1985).

Rowles (1983) argues that physical environments have a significant effect on all age groups, but the effect is greater on older people, and they are more sensitive to changes in their environment. In terms of environmental effect, Gilleard, Hyde, and Higgs (2007) argue that as people age their residential mobility decreases and they feel more attachment and belonging to their community. These effects are not limited to the design of dwellings. Neighborhood design has a significant impact on elderly safety, independence and social participation as well (Judd et al. 2010). Thereby, as people age, their neighborhood environment plays a crucial role in a successful aging in place and fulfilling their physical and emotional needs (König et al. 2019).

There is a long history of research on residential preference based on the importance of land cost and accessibility in people's decision (Harvey 1996; Levine 1998; Weisbrod, Lerman, and Ben-Akiva 1980; Cao 2008; Ettema 2010; Luckey et al. 2018; Yan 2020). However, in the last decades ways to represent residential models have changed. Many recent studies have argued that a variety of factors including building and location-specific attributes play a role in residential decisions other than land costs and commuting costs (Talarchek 1982; Wenning 1995;

M. J. Kim and Morrow-Jones 2005; Bayoh, Irwin, and Haab 2006; Hur and Morrow-Jones 2008; Schirmer, Van Eggermond, and Axhausen 2014b; Ardeshiri and Vij 2019).

In addition, researchers suggest that households' characteristics and values play a significant role in their residential decisions. Since values change with time and over the life span, these changes are presumably reflected in their residential preferences as well (Lindberg et al. 1992; Sommers and Rowell 1992, 1; Masnick 2002; Duncombe, Robbins, and Wolf 2003; J. H. Kim, Pagliara, and Preston 2005; Wu, Zhang, and Dong 2013; Schirmer, Van Eggermond, and Axhausen 2014b; Yi and Lee 2014; Jin and Lee 2018). Thereby even if one demographic group currently focuses on something, their preferences might change over their life span and other groups might not have the same concerns. Despite the fact that residential attribute preference change across the life span, research on preferred attributes of middle-aged group -- age 50 to 65-- has not received much consideration (S. Kim 2004; Demirkan 2007; Morrow-Jones and Kim 2009; Judd et al. 2010; Tokunaga and Murota 2023). Since baby boomers are a large portion of the current middle-aged group and will become a major portion of the senior population in the near future, studying and comparing their neighborhood and residential location preferences will help planners better aid these individuals to stay in their own neighborhoods as they age.

Research Purpose and Questions

Research studies suggest that currently older adults in the United States have various financial, political, social, and human resources obstacles and difficulties for aging in place (Russell, Skinner, and Fowler 2022). It is worth mentioning that we will all age and become older adults ourselves therefore, to achieve a successful aging in place it is important to make sure that our built environment supports aging in place and older adults' preferences and needs are met not only when they are above 65 years old but also when they are still active and planning for retirement. Thereby, this dissertation aims to first study the neighborhood preferences of middle-aged groups and compare them with older individuals and then investigate their access to the amenities that make their communities more age friendly. In order to achieve this goal, the study will answer the following questions:

1. What are the neighborhood attribute preferences of middle aged and older adults and how do they differ between these groups?
2. What is the spatial distribution of amenities in these individuals' neighborhoods and their access?
3. What are the mismatches between preferred and current neighborhood attributes of the targeted groups?

Chapter 2: Literature Review

US Demographic Change

In 2000 data from US Census Bureau revealed that 12.4 percent of the American population was over 65 years old. By 2011 this group's population was 40.3 million, and since January 1, 2011, for the next 20 years every day roughly 10,000 baby boomers -- born between 1946 and 1964 -- will turn 65 (DeNavas-Walt, Proctor, and Smith 2007; Pynoos et al. 2008; Howden and Meyer 2010; Gill and Moore 2013; Vespa, Medina, and Armstrong 2020). In the past decade the number of people in the United States who are 65-and-older grew by 34.2% or 13,787,044 people and by 3.2% or 1,688,924 people from 2018 to 2019. Due to the growth of this population the national median age rose from 37.2 years in 2010 to 38.4 years in 2019. In 2030 nearly one of every five Americans -- about 72 million -- will be an older adult. It is also anticipated that by 2060, over 90 million of the population will be aged 65 or older (US Census Bureau 2020).

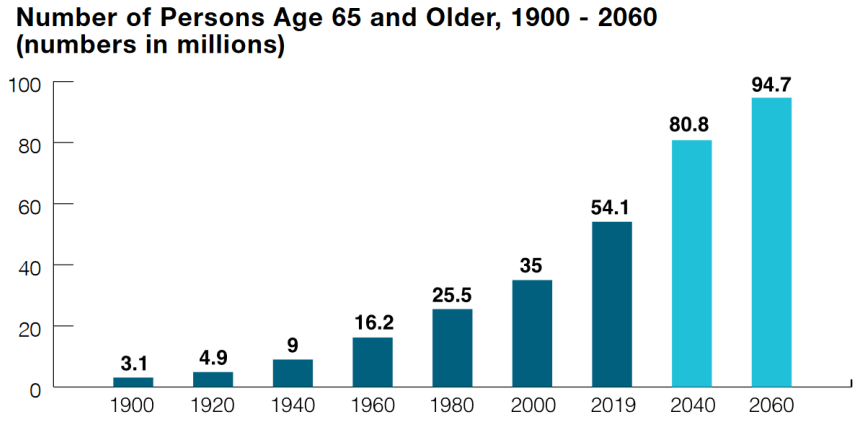

Figure 2: Number of persons aged 65 and older. Source: US Census Bureau, 2020

This dramatic change also stems from an increase in the life expectancy of the elderly. In 1900, the life expectancy was 47 years in the U.S., and it reached 76.64 in 2000. Due to improved health care life expectancy has been continuously increasing among seniors and the life expectancy for U.S. in 2020 was 77.0 years. By 2060 life expectancy is expected to increase to 85.6 (Erbas 2006; Miller and Annesley 2011; Cutler, Ghosh, and Landrum 2013; Verma 2014; West et al. 2014; Arias et al. 2022). According to Vespa, Medina, and Armstrong (2020) all racial and ethnic groups are expected to have gains in life expectancy, but the biggest ones are projected to be for black men, American Indian men and Alaska native men.

Aging in Place

Under current demographic projections the proportion of the elderly population is expected to increase, and the rate of growth will be even higher for the segment of the very old (aged 80 and over). Due to the rapid growth in the population aging, the significance of offering products and services that cater to the needs of older individuals is becoming more recognized by service providers and policy makers. Strategies and practices for ensuring a robust quality of life for older individuals have become an area of increasing interest for those who design the built environment (Scharf et al. 2002; Erbas 2006; Greenfield et al. 2015; World Health Organization 2023b).

Traditionally programs and public policies have focused on the delivery of assistance to targeted individuals. For example, the federal programs on the provision of healthcare and social services to older people, including the Social Security Act, the Medicaid Act, and the Older Americans Act were put in place during the 1960s by President Lyndon B Johnson's Great Society Act to provide essential support and care for older individuals (Gelfand 2006). However, in North America and Europe, the idea of “active aging” and aging in place has developed as a

paradigm shift in addressing the challenge of population aging (World Health Organization 2002; Greenfield et al. 2015). The concept of aging in place suggests that elderly individuals, can continue remaining in their own homes as long as they receive the necessary services and support (Cutchin 2004).

In 1973, Lawton and Nahemow proposed The Ecology Theory of Aging (ETA) and conceptualized aging well as involving person-environment interchange dynamic. The ETA offers a comprehensive framework encompassing diverse forms and levels of personal competence, such as sensory impairment, reduced physical mobility, and cognitive decline, along with objective environmental features like housing standards, neighborhood conditions, and public transportation. A fundamental premise of ETA is that unique combinations of personal competence and environmental attributes determine an individual's optimal level of functioning. Furthermore, the person-environment interaction term implies that due to variations in how person-related abilities and needs express themselves in various environments, they can result in distinct outcomes. (M. Powell Lawton and Nahemow 1973).

Literature on aging-in-place is often about making the home more functional and less risky for the older adults by providing various home aids (Bayer and Harper 2000; Judd et al. 2010). While most conversations about aging in place revolve around people’s homes, many environmental gerontologists and researchers suggest that neighborhoods and communities play a vital role in enabling individuals to continue living in their current location (M. P. Lawton 1977).

Research studies performed in various countries prove that aging in place is becoming increasingly attractive for many older persons (Carr et al. 2013; Erbas 2006; Hall 2015; O’Hehir 2014; Scharf et al. 2002). As people age, they become more attached to the place where they live

and more vulnerable to their social and physical environment (M. P. Lawton 1977; M. Powell Lawton and Nahemow 1973). Iecovich (2014) argues the term "place" not only relates to the seniors' homes but also their community which highlights the importance of neighborhood environment. As individuals grow older, they experience greater physical fragility or chronic health issues, and their physical or cognitive abilities may diminish. In this case, older individuals need extra assistance to maintain their independence (Alley et al. 2007). Successful and independent aging in communities is not possible without accessible and safe neighborhood environments, including built environment characteristics, physical and social support systems, and a wide variety of amenities (Alley et al. 2007; Wiles et al. 2012; Fitzgerald and Caro 2014).

The built environment plays a crucial role in older adults' participation in their communities. For instance, research studies have found that heavy traffic, inadequate security signs in the neighborhood, and poor access to public buildings can negatively impact social interaction and participation among individuals, especially those not using any mobility aid to get around (P. J. Clarke et al. 2011; P. Clarke et al. 2019). Additionally, built environment attributes like walkability, access to a public transportation system, access to parks, housing density, street connectivity, land use mix, safety and neighborhood appearance can increase physical activity among older adults and improve their well-being (Durand et al. 2011; Barnett et al. 2017; Van Cauwenberg et al. 2018; Song et al. 2020).

Aging in Place: the International Perspective

During the 1990s and early 2000s, the World Health Organization (WHO) started launching a number of policy initiatives that help experts develop age friendly communities. In 1999 during the United Nations' Year of Older people, the idea of "active aging" was developed by the European Union. Later in 2002, the WHO elaborated this notion as the idea that older

individuals should be able to continue participating in their social and physical environment. The WHO (2002) defines the term "active" as "continuing participation in social, economic, cultural, spiritual, and civic affairs, not just the ability to be physically active or to participate in the labor force. Older people who retire from work and those who are ill or live with disabilities can remain active contributors to their families, peers, communities, and countries. Active ageing aims to extend healthy life expectancy and quality of life for all people as they age, including those who are frail, disabled and in need of care".

In 2006, the WHO directed a project in 33 cities from all continents which led to a guide of "Global Age-Friendly Cities". This guide insists on making cities more aging-friendly to promote the wellbeing and participation of senior residents. Based on this report, active aging depends on a variety of material situations along with social factors that play an important role in people's behavior and feelings. All of these influential determinants define an age-friendly city and affect how well individuals age in place. The WHO categorized these factors in eight different groups as "Communication and Information", "Community Support and Health Services", "Outdoor Spaces and Buildings", "Transportation", "Housing", "Social Participation", "Respect and Social Inclusion", and "Civic Participation and Employment" (WHO, 2007b; Gonzales and Morrow-Howell 2009; Plouffe and Kalache 2010; Buffel, Phillipson, and Scharf 2012). The WHO project concluded that these features should be implemented as references for other communities to evaluate their strengths and gaps. Communities can also assess their progress in order to make their cities "friendly for all ages" and not just "elder-friendly" (WHO, 2007a: 72). In 2010 in an attempt to encourage implementation of policy recommendations from the 2006 project, the WHO launched the 'Global Network of Age-friendly Cities' including 47 individual cities (Buffel, Phillipson, and scharf 2012).

In 2023, the WHO released a new guide on developing national programs for age-friendly cities and communities. The new guide specifies both the rationale behind and a step by step, systematic method for creating age-friendly city and community initiatives on a national level. It also includes case studies from current, successful national programs for age-friendly cities and communities, as well as specific explanations of what may be done and how (World Health Organization 2023a). This guide provides a framework for governments to change their cities and communities to improve the well-being and ensure healthy aging for its population in more robust ways. The core elements of the framework are related to the following areas:

- partnerships, networking, and stakeholders
- leadership and strategic thinking
- human, financial, institutional, and cultural resources
- capacity-building
- knowledge, research, and innovation
- monitoring and evaluation

In the newly released document, the WHO presents a list of agencies developed all around the world that focus on age-friendly movement. AARP Network of Age-friendly States and Communities in the U.S., Age Friendly Ireland, Age Platform Europe, Centre for Ageing Better – United Kingdom Network of Age-friendly Communities, Office for Seniors- Government of New Zealand, Department of Seniors- Government of Queensland, Ministry of Health- Government of Singapore, International Federation on Ageing, Kanagawa Prefectural Government (Japan), Age-friendly Communities- Government of Canada, Instituto Nacional de Servicios Sociales para Jubilados y Pensionados (Argentina), and Servicio Nacional del Adulto Mayor (Chile) are some of agencies included in the list (World Health Organization 2023a).

Aging in Place: the U.S. Perspective

In the United States, the American Association of Retired Persons (AARP) Network of Age-Friendly Communities, joined the World Health Organization's Age-Friendly Cities and Communities Program in 2012. Since adopting the WHO framework, the AARP has conducted community surveys to enable older adults to rate the current state of their communities for "aging in place" and facilitate support systems to help people live easily and comfortably in their homes and communities as they age (AARP 2023). In 2014, AARP conducted the "What Is Livable? Community Preferences of Older Adults" survey on individuals aged 50 and older.

Based on the survey results, fewer senior residents choose to live in traditional retirement communities or age-segregated housing. A great number of these individuals desire to age in their community and remain in their own homes and communities where they have the feeling of belonging. Also, for individuals 50-plus, access to public transportation, groceries and green spaces were very important community features. When they were asked what these individuals want implemented to improve their communities, attributes and services like an increased police presence; improved schools; pedestrian-friendlier streets; better transportation for older adults and people with disabilities; new or improved parks gained the highest rankings (Harrell et al. 2014).

In 2022, the AARP published the report of their "2021 Home and Community Preferences" survey. Based on the results, nearly 80 percent of adults aged 50 and older want to age in place by remaining in their homes and communities where they have "spent years making connections and commitments". Findings indicate that the number of individuals that prefer to age in place has remained relatively consistent for more than a decade and was not impacted by the Covid-19 pandemic. The AARP states in order to facilitate aging in place, "people need homes and

communities that are affordable, safe and can support their needs". Also, it is crucial that individuals have access to high-quality health care providers, safe and accessible recreation spaces, conveniently located grocery stores, and infrastructure that reinforces community connectedness (AARP 2022).

Benefits of Aging in Place

Aging in a familiar and safe environment leads to various emotional and psychological advantages for older individuals. Providing them with control over their lives, enabling them to keep their identity, and improving their well-being are the reasons for which older individuals prefer to age in a familiar place surrounded by family and friends (Cutchin 2004; Farber et al. 2011; Fernald 2014; Rantz et al. 2005). In a recent study on 1,600 people aged 45 and older, AARP found that 73 percent prefer to stay in their current residences, and 67 percent like to remain in their communities as long as possible (Keenan 2010a).

In 2007, Clarity conducted research on attitudes of seniors and baby boomers on aging in place. Among a total of 804 random telephone interviews, 402 interviews were completed. The results demonstrated that the fear of losing independence causes many seniors not to choose nursing homes for living. A study done by Herzog and House (1991) showed that living independently increases life satisfaction, health, and self-esteem which are three keys to aging successfully. On the contrary, relocation causes loss of independence and social relationships, loneliness, adjustment difficulties, emotional stress, changes in daily routines and lifestyles, and overall decline in physical and psychological functioning in older adults (Chapin, Dobbs-Kepper 2001; Iecovich 2014; Staveley 1998).

The aforementioned discussions highlight the importance of managing, planning and designing communities that support aging in place. Many sociologists and environmental

gerontologists have argued that as people become older their attachment to the environment where they live increases (Lawton 1985). Rowles (1983) argues that physical environments have a significant effect on all age groups, but the effect is greater on older people. These individuals are more sensitive to changes in their environment. In terms of environment's effect, in 2007 Gilleard et al. found that as people age their residential mobility decreases and they feel more attachment and belonging to their community.

Aging in place is not only beneficial from the perspective of older individuals. Enabling older adults to stay in their homes and communities for an extended period also prevents the expensive alternative of institutional care, making it a preferred choice among policymakers and healthcare providers (Chappell et al. 2004; World Health Organization 2007; Kaye, LaPlante, and Harrington 2009; Iecovich 2014). In 2023, Curioni et al. conducted a systematic literature review on the cost-effectiveness of homecare services compared to in-hospital care for adults and older adults. The study results revealed homecare was generally more cost effective when compared to hospital care. Homecare can also influence the health and wellbeing of older adults. A review of the literature that examines home care compared to other care locations by Boland et al. (2017) indicated that homecare can positively impact the well-being of individuals aged 65 years and over. Given the importance of neighborhood design in successful aging and fulfilling individuals physical and emotional needs, research on residential choice of these individuals needs deep consideration.

Residential Location Choice Models

Cities' lands are mostly made up of housing, and residential household location is one of the important factors in urban dynamics (Schirmer, Van Eggermond, and Axhausen 2014). The choices individuals make about where to live and age affect the investments in urban

infrastructure and transportation, employment patterns, approaches to economic development, and neighborhood social structure (Huu Phe and Wakely 2000). Various determinants factors affect housing and neighborhood choices of people (Wiseman 1980; S. Kim 2004). Researchers have introduced three major approaches to model residential location including the monocentric model, the Lowery model, and the discrete choice model (Waddell 1997; Huu Phe and Wakely 2000; S. Kim 2004; Schirmer, Van Eggermond, and Axhausen 2014). These models are explained in detail as follows.

The roots of residential location modeling go back to Von Thunen's hypothesis about concentric city-region (1828). His theory of location is based on transport costs from a central market. Thunen's isolated state model consists of cospecializes of rural land use around a central market community in which each zone is specialized in a particular type of agricultural produce. Agricultural land uses with the highest transport costs and profits were found in the rings closest to the center. The first ring around the market community is dedicated to market gardening and fresh milk production, the second ring, dedicated to the production and harvest of forest products, the third ring, to crop rotation systems, and finally the fourth ring would be dedicated to livestock ranching (Harvey 1996; Arribas-Bel and Sanz-Gracia 2014).

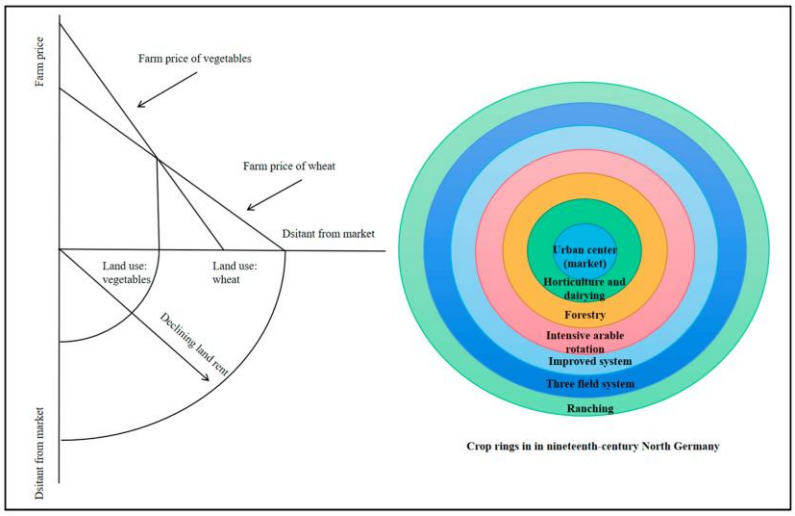

Figure 3: Schematic diagram of Von Thünen model. Source: Han, Yuan, and Zou (2022)

Von Thunen's concept was updated and built upon by Alonso (1964), Muth (1969), and Mills (1972). They propose a mono-centric city with employment opportunities that is isolated and functions independently from other cities. The number of residents is fixed in this model, and they live around a central business district (CBD). The CBD locates all the city's employment, services and goods. As one of the key features of the model it is assumed that each worker travels into the city center for work. Thereby employment as well as population density and land price increase in the central core since it is the most attractive location in the city.

Based on the monocentric model land is more expensive close to the center, which prompts homebuilders to economize on the use of land. Buildings closer to the CBD are higher and have smaller dwellings than those farther from the center. Since households living close to the city center have to travel less to get to work or entertainment center thereby rents are bid upwards and transportation costs are lower close to the city center. Households then choose to either live in well-located, but smaller and more expensive housing units or in more distant, but larger and less expensive towards the city fringe (S. Kim 2004; Lai and Tsai 2008).

In general, there is a negative correlation between the rent price and distance from the city center (Figure 4) and a positive correlation between transportation costs and distance from the city center. Since households have a combined rent and transportation budget constraint if transportation costs are higher, then the amount a household is willing to pay for rent is lower. Overall the monocentric model focuses on predicting residential location as a function of transportation and housing costs (Ahlfeldt 2008; Arribas-Bel and Sanz-Gracia 2014; Takahashi 2014)

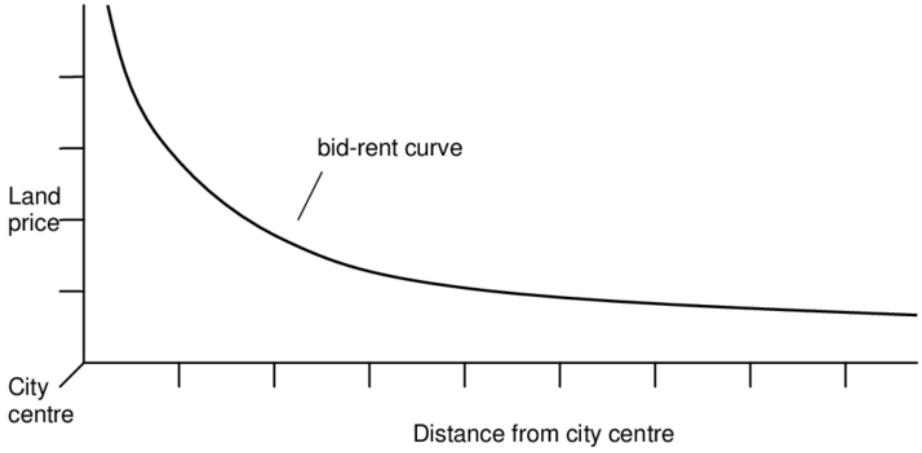

Figure 4: Rent function in the Monocentric model. Source: Alonso 1964

Even though the monocentric model provides the theoretical foundation for many residential location choice models, the validity of the model has been questioned. Researchers argue that the monocentric model oversimplifies the choices individuals and families make about where to live. For instance, it does not consider municipal policies (e.g. property taxes, zoning), neighborhood characteristics (e.g. crime, amenities), household characteristics (e.g. size, composition), socio-economic factors (e.g. race, income), cultural factors (e.g. ethnicity, group affiliation) and preferences (e.g. single family home, condominium) of residents (S. Kim 2004).

Furthermore, cities have become polycentric hence the suburbanization of population and employment opportunities have occurred (Griffith 1981; Rudzitis 1982; Berry and Kim 1993). The presence of multiple centers means population density at any location results from the layering of influences generated by different centers. The suburbanization of employment location means there will be more than one center for commercial and business activities in a metropolitan area which results in increased land price in these areas (Griffith 1981; Rudzitis 1982; Berry and Kim 1993; S. Kim 2004).

Parallel to Alonso, Lowry (1964) proposed the gravity model based on residents' access to jobs, which was one of the first proposed transportation and land use models. The impetus for creating the model was to simulate the residential and services location patterns in the Pittsburgh region. In this model residential location is determined by employment and more specifically by the costs involved in accessing to a place of work. Lowery assumed a set of basic and non-basic employment regions and proposed an iterative procedure that generates the spatial distribution of employment and population within a region. Basic industries can support nonbasic services with additional income that they generate by exporting much of their product outside the region. Nonbasic industries supported by basic industries then can serve households within the region (Iacono, Levinson, and El-Geneidy 2008; Schirmer, Van Eggermond, and Axhausen 2014b).

In Lowry's model the location of basic industries is fixed. Thereby population distribution is determined by employment location and households are allocated to zones based on the number of workers in that zone. Lowry's formulation shows that residents' willingness to commute from one zone to another one decreases as travel distance and cost increases.

$$f(t_{ij}) = \exp(-\beta t_{ij})$$

$f(t_{ij})$: a deterrence function value representing the inverse of the probability of workers working in zone i and living in zone j.

t_{ij} is a measure of the disutility of travel between zones, typically defined as travel time.

- -β represents the marginal disutility per unit of time.

This functional form assumes that only one household member is employed outside the home and workers choose to live near their workplace. Also, the higher the cost of commuting, the closer places of employment and residential areas are. Finally, residential attractiveness is measured by the amount of land available for development in a particular zone (Myung-Jin 2004; S. Kim 2004; Iacono, Levinson, and El-Geneidy 2008; Schirmer, Van Eggermond, and Axhausen 2014b).

Implementing Lowry's model needs modest data and a few parameter adjustments to analyze the impacts of major urban changes. However Berechman and Small (1988) argue the model lacks underlying economic or behavioral theory. Other criticisms of the model include the limitation of its applicability due to high sectoral aggregation between basic and nonbasic employment and ignoring the supply side of urban development like the housing industry (Jun and Moore 2002).

As Waddell (1997) discusses simultaneously a separate stream of research activity by McFadden (1973,1984), Quigley (1973, 1976) and others focused on household residential choice instead of rent price. These researchers worked on random utility theory to develop multinomial logit models of residential locations. This model assumes that residents make decisions about their residential location in a way to maximize their utility. Maximizing utility

means minimizing travel time and residents maximize their utility by weighting the characteristics of each available alternative such as work, shopping, and school accessibilities, neighborhood quality, level of public services, housing cost, taxes, travel costs, and housing characteristics (year built, number of rooms, etc.). The strength of multinomial logit model comes from the fact that one can avoid describing a residential location solely based on its distance to the city center or job locations. Also, this framework has the ability to quantify the impact of various residential location attributes and household characteristics on residential location choices (D. McFadden 1973; Waddell 1997; Schirmer, Van Eggermond, and Axhausen 2014b).

However, in the last three decades thinking about the mechanisms and behaviors associated with housing choice has changed. Recent studies have argued that a variety of factors including building and location-specific attributes play a role in residential decisions other than land costs and commuting costs (Talarchek 1982; Wenning 1995; M. J. Kim and Morrow-Jones 2005; Bayoh, Irwin, and Haab 2006; Hur and Morrow-Jones 2008; Schirmer, Van Eggermond, and Axhausen 2014b). For example some studies have found that school quality is one of the household's priorities in locational choice and affect house prices (Haurin and Brasington 1996a; 1996b; Guo and Bhat 2002; M. J. Kim and Morrow-Jones 2005; Bayoh, Irwin, and Haab 2006). In 2005 Kim and Morrow-Jones used a survey of new home buyers and found that distance to work was relatively unimportant. This study concluded that various factors affect residential location decisions including housing characteristics (floor plan, quality of construction, and cost), community characteristics (safety of the neighborhood and good investment or resale value), and school quality (school reputation and quality of schools' academic programs).

Many studies have discovered that households' characteristics including size, income, social class or ethnic background, and household lifestyle play a significant role on their residential decisions (Duncombe, Robbins, and Wolf 2003; J. H. Kim, Pagliara, and Preston 2005; Wu, Zhang, and Dong 2013; Schirmer, Van Eggermond, and Axhausen 2014b; Yi and Lee 2014; Jin and Lee 2018). For example studies on residential choices have demonstrated that whites prefer predominantly white neighborhoods, while blacks tend to favor integrated neighborhoods (Clark 1991; Farley et al. 1994; Bobo and Hutchings 1996; Krysan and Farley 2002; Adelman 2005; Ibraimovic and Hess 2018).

According to Walker and Li (2007) lifestyle preferences are key determinants of residential location behavior and can be identified from observed choices of residential location. They believe that "there are three lifestyle segments: households that are suburban, auto, and school oriented; households that are transit oriented but want a suburban setting, and households that are urban and auto oriented". In addition, in their study, Krizek and Waddell (2002) found correlations between lifestyle-related explanatory variables and transportation choices. They addressed nine lifestyles that affect households' mobility behavior and residential location choices. These lifestyles are "retirees; single, busy urbanists; elderly homebodies; urbanists with higher income; transit users; suburban errand runners; activity-oriented families; suburbanites with double income; and exurban, family commuters. Based on this study, non-family households tend to locate in the central business district area while child-rearing family households locate in more suburbanized areas. A summary of discussed models is presented in Table 1.

Model	Explanation
Concentric Model by Von Thunen (1828).	Thunen's theory of location is based on transport costs from a central market. This model aims to explain the spatial organization of agriculture and how it is influenced by transportation costs.
Monocentric Model by Alonso (1968), Muth (1969), and Mills (1972).	The monocentric model is based on the bid-rent function. It assumes that there's a negative relationship between land price and the distance of land from the city center
Gravity Model by Lowery (1964).	This is one of the first transportation and land use models based on access of population to jobs. According to this model, employment location determines residential location, and the propensity of travel decreases with increasing distance.
Random Utility Model by McFadden (1973), Quigley (1973), And others.	This model assumes that residents make decisions about their residential location in a way to maximize their utility. Maximizing utility means minimizing travel time to access utilities.
The Life Course Model in the past two decades.	A variety of factors including building, location-specific attributes, and households' characteristics and lifestyle influences residential decisions other than land costs and commuting costs.

Table 1: Summary of residential location choice models

Residential Location Choice Across the Life Span

Studies on residential location choices have revealed that desires and preferences of different age groups change with time and across the life span (Lindberg et al. 1992; Sommers and Rowell 1992; Masnick 2002; Morrow-Jones and Kim 2009; Schirmer, Van Eggermond, and Axhausen 2014b). Morrow-Jones and Wenning (2005) suggest that at different stages of life, household characteristics and their roles in the family might affect people's residential location preferences. Change in residential preferences are also a reflection of change in households' values that occur over the course of life (Michelson 1977; Rossi and Shlay 1982). Furthermore as people age their mobility decreases as middle aged and older households are less likely to move than younger households (Lu 1998). To understand the complexities of different household residential location decisions their preferences should be scrutinized based on disaggregated datasets. To identify these preferences, a range of peer-reviewed journal papers, working papers, theses, and dissertations that address residential choice were examined. When deciding these studies' results, only results relating to neighborhood attributes were included. Table 2 shows a summary of these reviewed studies.

Author (Year)	Attributes
Wiseman (1980)	Climatic, scenic, and recreational amenities Local availability of activities and social contact Be near kin, especially children
Lindberg et al. (1992)	**Housing attributes/Neighborhood attributes** Suitable for children, Low noise level, Clean air, Pleasant outdoor environment, Little crime, Low traffic intensity, Low population density, Nice neighbors, Good public transport, Good local services, High status **Location attributes**

	Close to school, Close to recreation facilities, Close to stores, businesses, and shopping centers, Close to cultural offerings and entertainment, Close to your workplace, Close to nature, Close to homes of friends and relatives
Filion, Bunting, and Warriner (1999)	**Accessibility variables** Living close to stores, living close to work or school, living close to friends and family, Living close to major roads, Living close to expressways, Living close to bus route **Place variables** The appearance of your home, your home' s privacy, Living in an attractive area, Living in a safe place, Living in a quiet place, Living in an area with parks and green space **Setting** Houses are not close together, houses mixed with shops, same-size houses in neighborhood, Newer neighborhood, houses mixed with low-rise apartments, townhouses, etc. **Availability** Types of housing available match consumer demand
Huu Phe and Wakely (2000)	**Housing status** Distance to city center, the presence of good access to the street, Unit Location
Humpel et al. (2004)	Accessibility Safety
	Aesthetic environment Attractive neighborhood, No trash and litter on the street, Interesting activities in the neighborhood, Enjoyable scenery in the neighborhood, No noise in the neighborhood, well maintained buildings and homes, interesting buildings and houses

Echeverria, Diez-Roux, and Link (2004)	**Walking/exercise environment** Neighborhood offers many opportunities to be physically active, Local sports clubs and other providers, pleasant to walk, enough trees in the neighborhood to provide shade, Not a heavy traffic in the neighborhood, Not busy roads to cross when out for walks, Easy to walk to places, stores within walking distance of home, streets and sidewalks are in good condition, other people walking in the neighborhood, other people exercise (for example, jog, bicycle, play sports) in the neighborhood **Safety from crime** feel safe walking in the neighborhood during the evening, neighborhood is safe from crime, Violence in the neighborhood **Access to healthy foods** Availability of high quality products in the neighborhood, large selection of fresh fruits and vegetables available **Social cohesion (Sampson scale)** A close-knit or unified neighborhood, People around here are willing to help their neighbors, People in the neighborhood generally get along with each other, People in the neighborhood can be trusted, People in this neighborhood share the same values **Violence in past 6 months** Fight with gun, Gang fights, Sexual assault or rape, Robbery or mugging
J. H. Kim, Pagliara, and Preston (2005)	Travel time to work Travel cost to work Travel cost to supermarket Population density CITY Location of residence (city or suburban) Quality of school

World Health Organization (2007b) And AARP (2022)	Outdoor spaces and buildings Transportation Social Participation Respect and social inclusion Civic participation and employment Communication and information Community and health services
(Cao, Mokhtarian, and Handy 2007)	Accessibility Physical activity options Safety Socializing Attractiveness Outdoor spaciousness
Morrow-Jones and Kim (2009)	**Reasons for choosing the current neighborhood** Reputation of schools, Traffic in the neighborhood, Economic characteristics of the neighborhood, Racial composition of the neighborhood, Safety of the neighborhood, Quality of local garbage collection, Quality of local police services, Quality of local road maintenance, The number of parks and open space, General appearance of neighborhood **Accessibility-related reasons** Distance to work, Distance to family and/or friends, Wanted to be closer to more desirable shopping areas, Community recreational opportunities, Decreased my commuting cost, Less traffic congestion on my new commute, Availability of public transit, Ability to walk to stores and services
Troped et al. (2010)	**Street Connectivity** Intersection density (intersections per kilometer **Land use mix** **Density** Residential population density

	Greenness
	Vegetation index
Van Dyck et al. (2012)	Walking and cycling facilities
	Aesthetic
	Traffic safety
	Crime safety
	Parking near local shopping areas
	Residential density
	Land use mix-diversity
De Meester et al. (2014)	**Residential Density**
	Presence of different types of residences (e.g. detached single-family residences, row houses, apartments
	Land use mix diversity
	Distance to local facilities (e.g. supermarket, post office, library)
	Land use mix access
	Access to neighborhood services (e.g. ease to walk to public transport, ease to walk to school)
	Connectivity
	Connectedness of street network
	Availability of walking and cycling infrastructure
	Quality and maintenance of walking and cycling infrastructure.
	Aesthetics
	Presence of aesthetic features (e.g. green spaces, attractive buildings, streets free from litter and graffiti
	Safety for traffic
	speed of traffic in neighborhood, availability of pedestrian crossings and traffic signals
	Safety for crime
	crime prevalence in the neighborhood, perceived safety from strangers

	Convenience of recreation facilities Distance to PA facilities
Schirmer, Van Eggermond, and Axhausen (2014)	**Built environment** Built density, Open space, Land use, Network/noise **Socio-economic environment** Population density, Household type, Employment, Crime **Points of interest** Education, Urban character, Service and retail, Sport and recreation, Transport **Access & Accessibility** Commuting time, Sociodemographic **Previous location & Social networks** Individual distances
Dijk et al. (2015)	**Outdoor spaces and buildings** A clean and green neighborhood, A neighborhood with wide sidewalks and safe crosswalks, Public buildings with elevators that are easily accessible for wheelchairs and walkers, A safe neighborhood, A calm neighborhood **Transportation** Good public transport, Enough parking spots **Social participation** A neighborhood where many social activities are organized, Affordable activities for older people. **Respect and social approval** A neighborhood where people have respect for older people, A neighborhood where people are willing to help each other whenever necessary, no majority of immigrants in the neighborhood, A neighborhood where people know each other and dare to approach each other.

	Civic participation Possibilities for voluntary work, A neighborhood where older people are involved, for example concerning changes in the neighborhood **Community support and health services** A neighborhood where home care is easily accessible, A neighborhood where caregivers collaborate and keep each other informed, A neighborhood with general practitioner (GP) and pharmacy at walking distance, Places where older people can go for advice and support, Volunteers who provide help when necessary, Shops and other facilities within walking distance
Child et al. (2016)	**Accessibility** High dwelling density, Destinations within walking distance, Access to amenities, Access to transit stops **Structural support** Presence of sidewalks, Sidewalks are maintained, Presence of bicycle facilities, Facilities for bicycling are maintained, Presence of low-cost recreation facilities, High street connectivity **Safety**
Novianto et al. (2016)	**Amenity** Nature, Park and green space, City/town beauty **Safety** Streetlight, Bicycle path, Blind spot, Traffic situation, Road maintenance, Shelter, Pedestrian, Security post, Disaster **Health** Sewage, Noise, Vibration, Garbage **Convenience** Supermarket, Elementary school, Post office, Middle/high school, Bank, Train station, Library, Bus stop, Medical facility, Leisure place

Binette and Vasold (2018)	Transportation Community Service and Features (a. Sidewalks and Streets safety, b. Outdoor Spaces & Buildings) Social Participation
(Andersson, Abramsson, and Malmberg 2019)	Close to the family Close to forests and land Close to city life Close to grocery shops Services and culture Close to public transport
Lee (2019)	Neighborhood Safety Commute/Job Considerations Neighborhood Public School Quality Investment Value Proximity of Family/Friends Co-ethnic Businesses Neighborhood Racial/Ethnic Composition Entertainment Options
(Jamal, Newbold, and Scott 2022)	Living within walking distance of shopping areas Living within walking distance of entertainment (restaurants, movies, clubs, etc.) Having easy access to the highway Having good public transit service Living in a quiet neighborhood Having lots of people out and about in the neighborhood Having a high level of upkeep in the neighborhood Having big trees on neighborhood streets Having lots of off-street parking (garages or driveways) in the neighborhood

Table 2: An overview of studied literature

There have been many studies on residential location choices of families with school aged kids. Also, since the WHO launched the Global Age Friendly initiatives there has been more focus on different approaches to make communities and neighborhoods more age friendly. However, studying and comparing neighborhood preferences across different stages of life has not gained enough consideration. Among the included studies in table 2, a few focused on comparing neighborhood preferences of older adults versus the younger groups.

For example in their paper, Jamal, Newbold, and Scott (2022) compared young and older adults' attitudes and preferences towards different travel modes and residential characteristics. Although their study contributes to the field by adding more insight on residential preferences, it compares the preferences of 18–34-year-old individuals versus age 65 plus and their study was done in Ontario Canada. Furthermore, while the AARP study is one of the most comprehensive studies focused on age friendly initiatives it investigates home and community preferences of adults aged 18 plus nationally and analyses the 18–49-year olds' preferences versus individuals aged 50 and over descriptively. There are still some unanswered questions about differences in the residential location preferences of individuals aged 50-64 versus older adults, and their needs and challenges related to aging in their neighborhoods that I'm trying to answer in this study.

Chapter 3: Method

Research Design

In this dissertation I examine the preferences for attributes that promote aging in place among a sample of individuals aged 50 and older, living in Norman, OK. I identify existing amenities that promote aging in place in the neighborhoods and compare these to the participants' preferences. To do this, I employed a quantitative design, beginning with a survey to identify the neighborhood attribute preferences of middle age and seniors of Norman and answer the first research question. After analyzing the survey data, I inventoried a set of community amenities identified through the literature review as part of building age friendly neighborhoods. I map participants and existing amenities to examine the distribution of these individuals and their access to the built environment attributes and answer the second question. At the end, results from the two databases are combined and compared to have a better understanding of the phenomena (Creswell and Clark 2017) and answer the third research question.

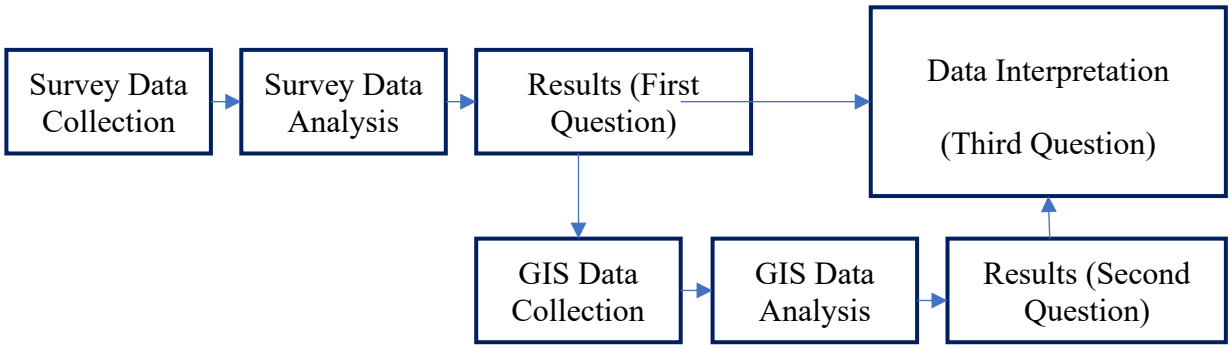

Figure 5: Research flow

Data Collection

In order to answer the research questions, this project focuses on individuals aged 50 or older in Norman, Oklahoma (Cluster sampling). The method of collecting primary data had two components: a questionnaire on neighborhood attributes preferences and using GIS mapping tools. Once the University of Oklahoma Institutional Review Board's permission was granted, I posted the research flyer with a link to the survey on different Facebook groups related to Norman communities. At this stage information about participation's location was collected. One of the questions was about naming the nearest intersection to their homes.

Survey Data Collection

To design the survey questions, scholarly research articles and studies that have worked on household's residential location decisions were examined. When deciding these studies' results, only those related to neighborhood attribute preferences were included (Table 2). Attributes mentioned in these studies were compared and combined to develop a survey instrument that was employed in collecting the data (Table 3). The questionnaire had 25 questions categorized in 6 major themes as respondent characteristics; physical environment; transportation; accessibility; well-being, safety, and security; and community values.

Attributes	Measurements
Respondent Characteristics	Age Gender Race Education Marital status Employment Living with someone under the age of 18 Disability Home ownership Income Traveling mode Length of living in the neighborhood
Physical Environment	Well maintained streets Low density Enough benches for resting in public areas, along sidewalks, and around public buildings The general appearance of buildings in the neighborhood and clean neighborhood Parks and green spaces Public buildings and spaces that are accessible to people of different physical activities
Transportation	Bus routes Bicycle facilities Public transportation Close to major roads Special transportation options for the elderly and people with disability Conveniently located public parking lots including parking for people with disabilities
Accessibility	Homes of friends and relatives within walking distance Recreation facilities within walking distance Grocery stores within walking distance Cultural offerings and activities within walking distance Religious centers (Church, mosque, synagogue, …) Access to downtown/city center within 20-minute driving distance Access to the workplace within 10-minute driving distance Doctor, pharmacy, and emergency care centers within walking distance

	Access to places where older people can go for advice and support (e.g. senior center)
	Access to social clubs such as book, gardening, craft or hobby within walking distance
	Affordable delivery system
Well-being, Safety, and Security	Low noise level and Calm
	Clean air
	Little crime
	Reduced (15-25 mph) speed limits for cars
	Low traffic intensity
	Safe public transportation stops or areas that are accessible to people of varying physical abilities
	Sidewalks that are in good condition and accessible for wheelchairs or other assistive mobility devices
	Safe crossings that have both audio and visual signals
	Separate pathways for bicyclists and pedestrians
	Having an emergency shelter within walking distance (For tornado, flood, …)
Community Values	High Social status
	Having the opportunity to participate in decision making bodies such as community councils or committees
	Nice neighbors
	Racial/Ethnic diversity of the neighborhood
	No majority of immigrants in the neighborhood
	Majority of people from the same race/ethnicity as you in the neighborhood
	A neighborhood where people know each other
	A feeling of belonging to the neighborhood
	A neighborhood where people have respect for older people
	A neighborhood where people are willing to help each other whenever necessary.
	Shared religious beliefs

Table 3: Summary of neighborhood attributes based on the literature.

Modifying the Survey Instrument

Certain survey questions were sourced from the AARP Livable Communities questionnaire (2018), while the rest were derived from research findings outlined in Table 2. Once the survey was compiled, two experts in the field reviewed the questions for their suitability (content validity) and comprehensibility (wording). Additionally, the survey was presented during a meeting attended by a group of senior residents, and their feedback guided the final structuring of the questionnaire. Subsequently, internal consistency (reliability) was assessed using Cronbach's Alpha (Appendix A). The alpha coefficient for the 45 Likert Scale questions in the survey is 0.903 with a range of 0.898-0.906, suggesting that the items have relatively high internal consistency.

GIS Data Collection

After analyzing the survey results and finding the nearest intersections to the participants, these locations were pinpointed on Google Earth (Figure 6). Data regarding age-friendly features within the urban infrastructure was gathered using resources such as The City of Norman's website and Google search engine. The features within the built environment were categorized into four groups: transportation (T), nutrition (N), medical Care (MC), and recreation (R). These services were extracted from both Table 3 and the survey responses.

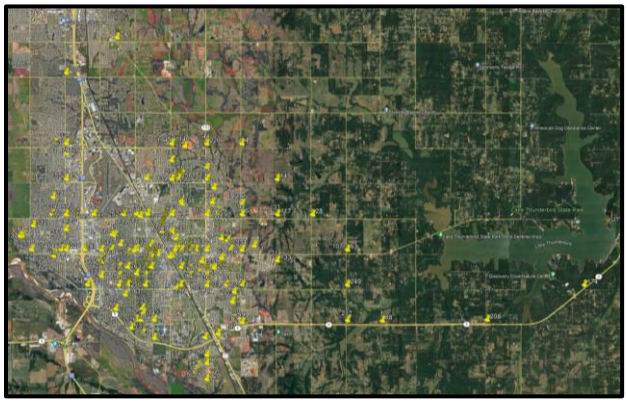

Figure 6: Map of pinned intersections on Google Earth

In the nutrition category, a list of existing grocery stores and their addresses were collected. Under medical care, all medical centers and pharmacies were identified. For the recreation category, parks and recreation centers within the city's boundary were located through Google search. Lastly for the transportation category, the lists of existing bus stops and routes were compiled through the City of Norman Transportation Website, Embark. Once the addresses of these facilities were discovered, their coordinates were pinpointed on Google Earth. Afterwards, the data from Google Earth was stored as a KML layer, which was then imported into ArcMap for analysis. Data on bike routes, sidewalks, and the city's boundary was downloaded from the GIS Services Division on the City of Norman's website. Figures 7-13 show the nearest intersections to participants and age friendly built environment features in Norman, Oklahoma.

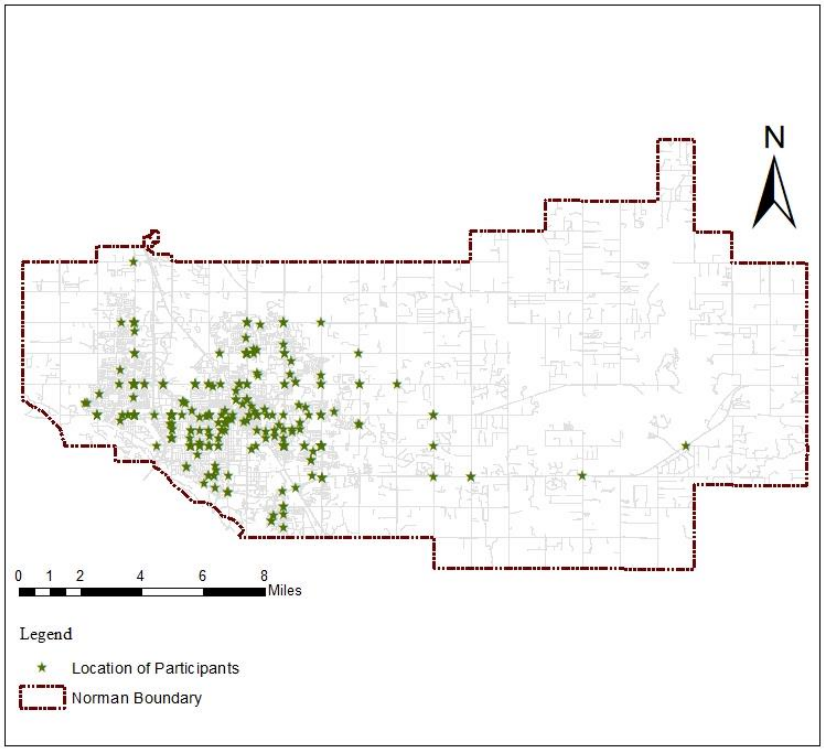

Figure 7: Location of participants

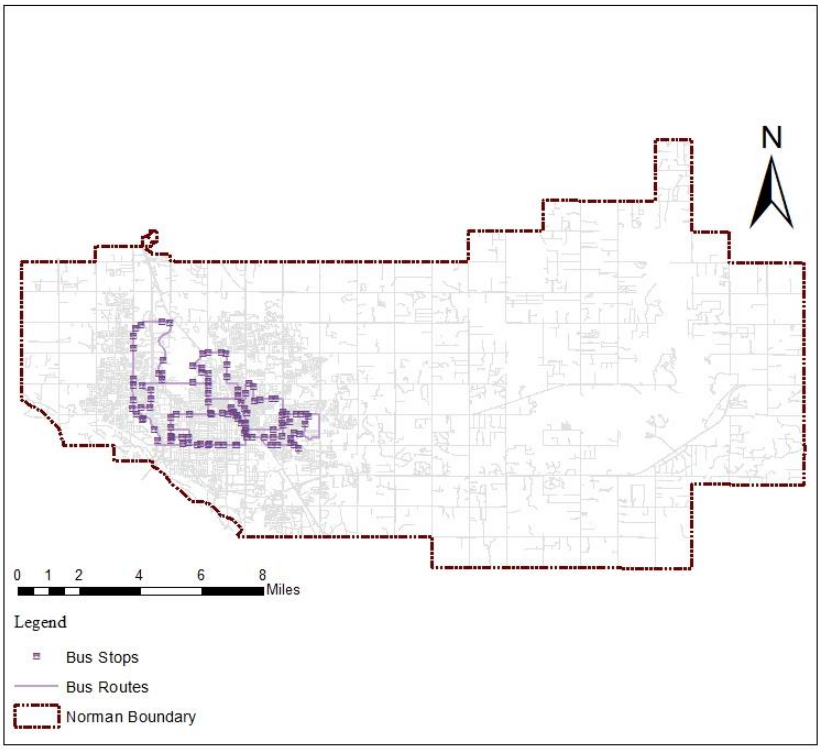

Figure 8: Location of bus stops and bus routes

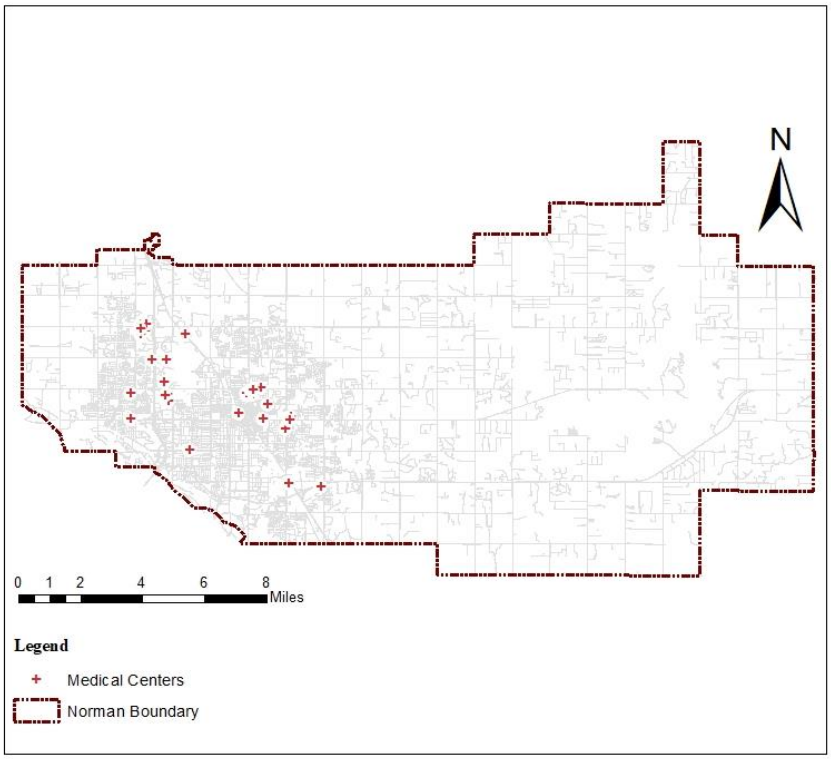

Figure 9: Location of medical centers (hospitals and urgent cares)

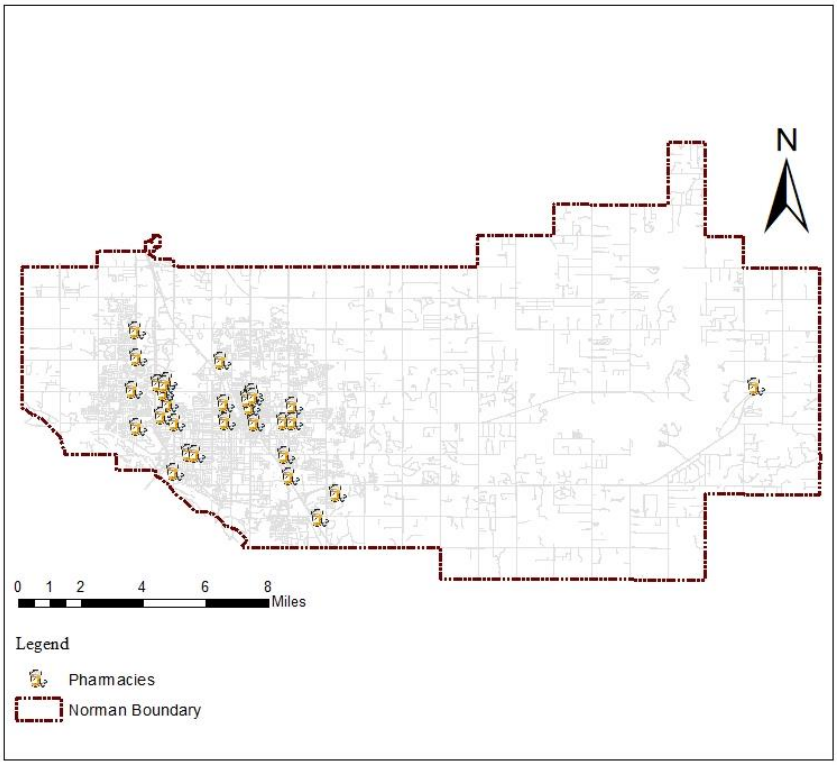

Figure 10: Location of pharmacies

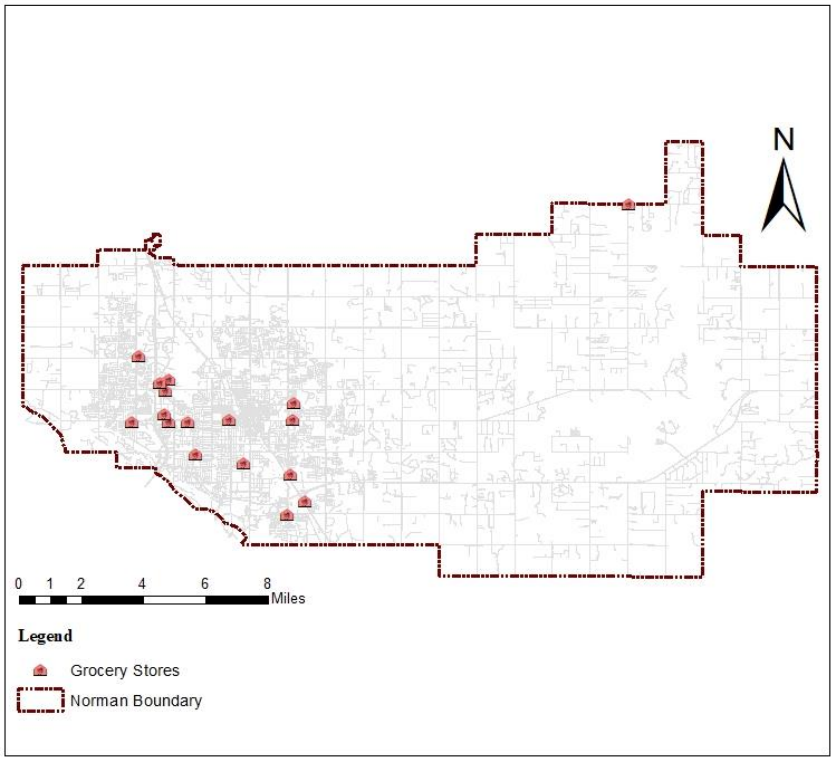

Figure 11: Location of grocery stores

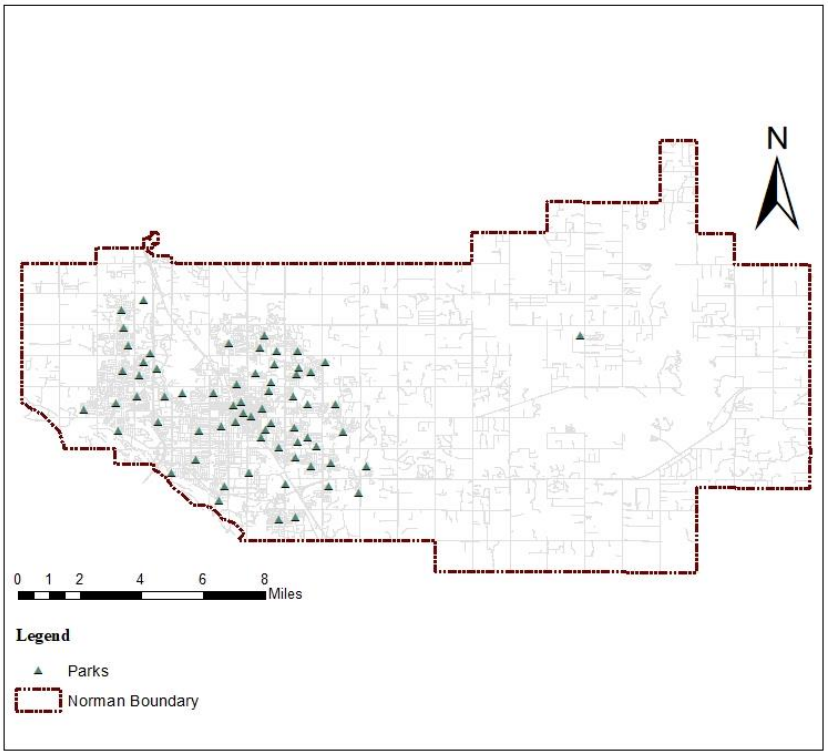

Figure 12: Location of parks

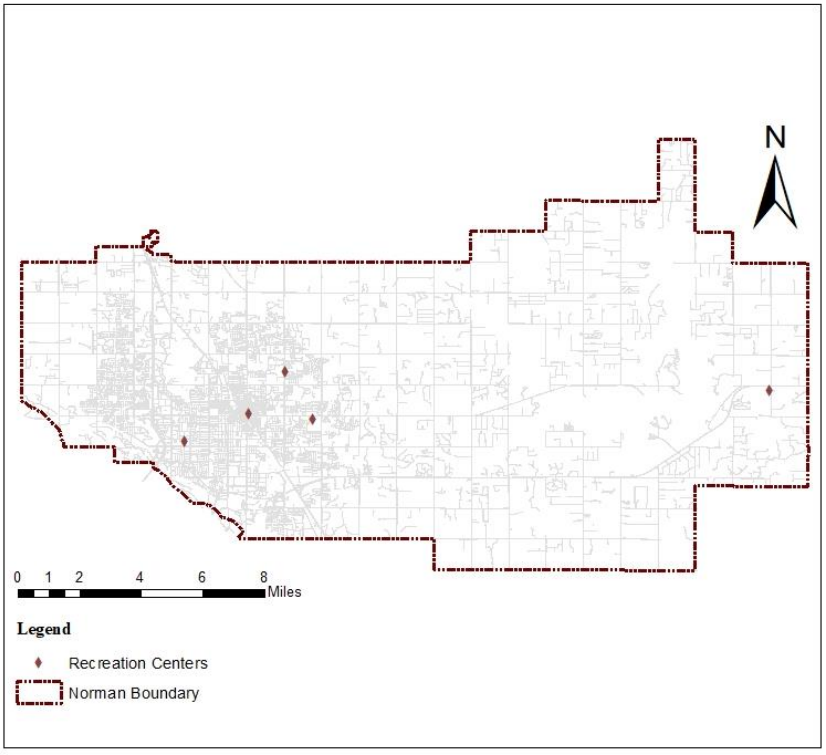

Figure 13: Location of recreation centers

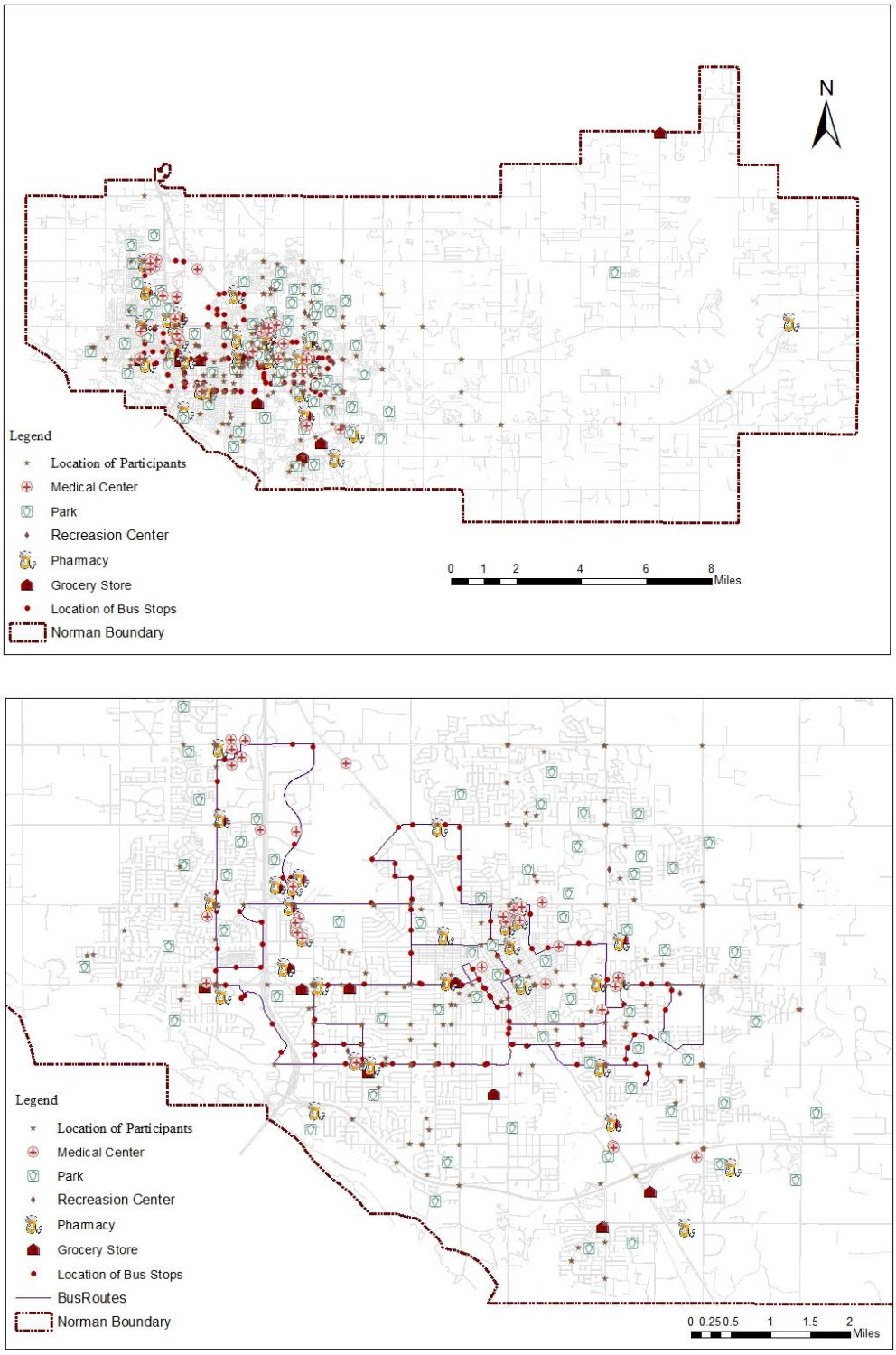

Figure 14: Distribution of services in Norman (Top), and magnified view of them (Bottom).

Data Analysis

Survey Data Analysis

Out of 319 responses two were deleted since the location of respondents were not within the city boundary and thirty-two participants' responses were eliminated due to not answering sixty percent or more of the questions in the survey, leaving a final sample size of 285. The Little's missing completely at random (MCAR) test was conducted using R programming for the remaining responses. Once confirming the randomness of missing data, mean imputation was used to address the missing data. Statistical Package for the Social Sciences (SPSS) version 28 and R packages were used for statistical computing.

First the frequency and percentage of the Likert scale questions were calculated (Appendix A). The Mann-Whitney U test was performed afterwards. The MWU test is a non-parametric test that is used to compare two sample means that come from the same population, and used to test whether two sample means are equal or not (Mann and Whitney 1947). The demographic questions in the survey were analyzed descriptively and the Pearson Correlation Coefficient test was conducted to test the relationship between variables. The Mann-Whitney U test was also conducted for other independent variables to verify if they make any differences in the neighborhood attribute preferences. Two questions in the survey were open ended and asked participants about the things they like or dislike in their neighborhood. Their answers were compared/combined with the Mann-Whitney U test outcome.

GIS Data Analysis

Transportation system and land use pattern define user's accessibility to services. Transportation may be measured as "travel time" or "distance". The land use dimension of accessibility can also be described as its "attractiveness," "opportunity," or "activity." Based on

the relationship between these dimensions, 5 accessibility measures are used in the literature. The measures of accessibility are spatial separation, cumulative opportunities, gravity, utility, and time-space (Bhat et al. 2001). Due to the ease of computing and interpretation, the cumulative opportunities measure is adopted by many planning agencies and used in this study as well. This model assumes that only opportunities reachable within a specific travel time limit using a particular mode of transportation are considered accessible, whereas those beyond this limit should not be counted as accessible (El-Geneidy and Levinson 2022).

Determining the optimal travel time threshold to use in this model is a topic of ongoing discussion in the planning and transportation field (Páez, Scott, and Morency 2012). To analyze the participants' access to the built environment features in their neighborhood, this dissertation focuses on walking as the mode of transportation. Walking can be linked to attributes of the built environment such as how close destinations are or nonphysical aspects like safety. Based on different studies for the last two decades, in the United States approximately 0.25 miles (a distance of approximately 400 meters, equivalent to a 5-minute walk) has been considered the distance that Americans would prefer to walk rather than using a vehicle (Atash 1994; Aultman-Hall, Roorda, and Baetz 1997; Pikora et al. 2002; Krizek 2003; Hoehner et al. 2005; McCormack, Giles-Corti, and Bulsara 2008). However, walking trips like 0.5 miles (1—minute walk) may not be uncommon in some cases (McCormack, Giles-Corti, and Bulsara 2008). Thereby, the 0.25- and 0.50-miles thresholds are used in this dissertation to assess the accessibility of services for individuals aged 50 and older.

After finding the nearest intersection to the participant's home address two geodesic buffers within the 0.25 miles and 0.5 miles distances from each intersection were created (Fig 15). To assess service accessibility for each intersection the number of bus stops, grocery stores,

medical centers, pharmacies, parks, and recreation centers were counted within each buffer zone (Appendix A). Mean, median, range, and standard deviation were calculated for these services, and the Kernel Density tool in ArcMap was used to visualize the density of these services in the city.

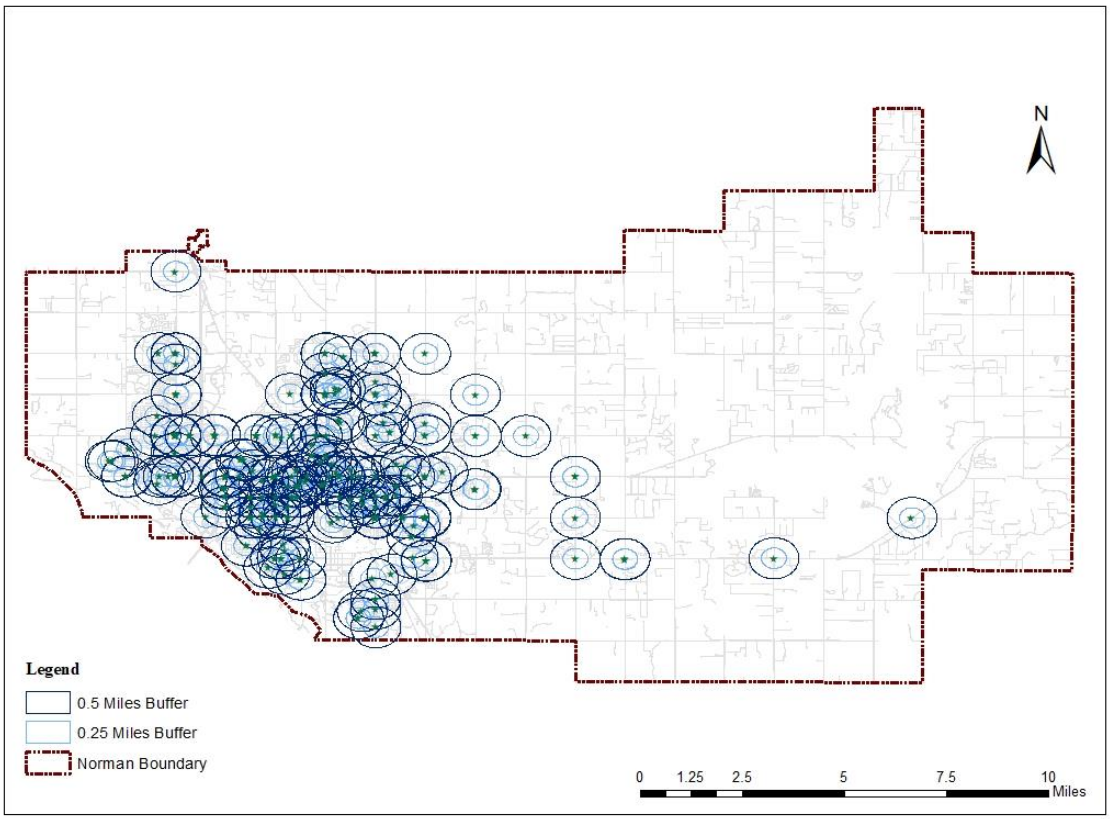

Figure 15: 0.25- and 0.5-miles buffer distances around intersections

Chapter 4: Results

This dissertation aimed to compare the neighborhood attributes of middle-aged with older adults and investigate their access to the built environment features that make their neighborhoods more age friendly. The following section describes the collected data, followed by the results of descriptive statistics, Mann–Whitney U test, and spatial analysis.

Survey Results

Description of Sample

A total sample of 319 individuals aged 50 or older were recruited between March and October 2020. The research flyer was posted in different groups on social media, and the participants were recruited on a voluntary basis. By removing two participants that were located outside the study area and 32 incomplete surveys, the total sample was reduced to 285. Out of 285 participants, 143 individuals were aged 50-64 (50.2%), and 142 of them were 65 or older (49.8%). These individuals consisted of 229 (80.4%) women and 56 men (19.6%). The majority of respondents were white or Caucasian (90.9%). The survey also collected information about these individuals' disabilities, and 132 (45.6%) of them declared themselves or someone in their home as having a disability. The demographic characteristics of participants are summarized in Table 4.

Variable	Groups	Frequency	Percentage
Age	50-64	143	50.2
	65 and Older	142	49.8
Gender	Male	56	19.6
	Female	229	80.4
Race	White or Caucasian	259	90.9
	Non-White	26	9.1
Education	No College Degree	46	16.1
	College Degree or Higher	239	83.9
Marital Status	Married or Living with Somebody	172	60.4
	Single	113	39.6
Employment	Still Working	120	42.1
	Not Working	165	57.9
Someone Under the Age of 18	Living with Children or Relatives Under 18	27	9.5
	Living without anyone Under 18	257	90.5
Disability	Someone with Disability in the House	132	45.6
	No Disability	152	53.6
Home Ownership	Own	252	88.4
	Rent	30	10.5
	Live with Somebody Else	3	1.1
Income	Less than $40,000	58	20.4
	$40,000 to $60,000	51	17.9
	$60,000 to $80,000	51	17.9
	$80,000 to $100,000	49	17.2
	$100,000 and more	72	25.3
Traveling Mode	Driving or Being Driven by Someone	274	96.1
	Other Modes	11	3.9
Length of Living in the Neighborhood	Less than 15 years	124	43.5
	16 years and more	161	56.5

Table 4: Characteristics of participants, n = 285

After analyzing the variables descriptively, the Pearson Correlation Coefficient test was conducted to examine the relationship between variables. Results showed that variables such as age and race, age and employment; race and length of living in the neighborhood; employment and disability; and disability and race were correlated. The Result of the Pearson Correlation Coefficient test is presented in table 5.

Variables	Correlation Results	Age	Race	Marital Status	Employment	Length of Living in the Neighborhood	Disability	Income
Age	R value	1	-.121*	-.062	.480**	.025	-.091	.034
	Sig.		.042	.299	<.001	.671	.125	.574
	N	285	285	285	285	285	285	281
Race	R value	-.121*	1	-.008	-.051	.155**	.149*	.027
	Sig.	.042		.897	.394	.009	.012	.648
	N	285	285	285	285	285	285	281
Marital Status	R value	-.062	-.008	1	-.006	-.099	-.036	-.530**
	Sig.	.299	.897		.918	.096	.548	<.001
	N	285	285	285	285	285	285	281
Employment	r value	.480**	-.051	-.006	1	.054	-.133*	-.095
	Sig.	<.001	.394	.918		.361	.025	.114
	N	285	285	285	285	285	285	281
Length of Living in the Neighborhood	r value	.025	.155**	-.099	.054	1	.005	.119*
	Sig.	.671	.009	.096	.361		.930	.046
	N	285	285	285	285	285	285	281
Disability	r value	-.091	.149*	-.036	-.133*	.005	1	.156**
	Sig.	.125	.012	.548	.025	.930		.009
	N	285	285	285	285	285	285	280
Income	r value	.034	.027	-.530**	-.095	.119*	.156**	1
	Sig.	.574	.648	<.001	.114	.046	.009	
	N	281	281	281	281	281	280	281

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5: Pearson Correlation Coefficient test results

Aging in place

In 2021, the Home and Community Preferences survey conducted by AARP found that 77% of adults ages 50 and older want to stay in their homes, and 79% want to stay in their communities. This dissertation's findings were consistent with previous data on aging in place, and most participants responded they prefer to stay in their homes and communities as they age. Findings showed that for 278 individuals (97.5%), it is important to be able to stay in their homes, and for 238 of them (83.5%), it is important to stay in their neighborhoods. More than 80% of the participants rate their neighborhood a good place for people as they age, and it is very likely or likely for 80.4% of them to recommend living in their neighborhood to older adults. Furthermore, the findings suggest that 252 participants own their home (88.4%), and 161 (56.5%) have lived in their neighborhoods for more than 16 years.

Neighborhood Attribute Preferences

To identify the most preferred and important neighborhood attributes among the middle aged and older individuals, frequency, mean, and standard deviation for the Likert questions in the survey were calculated, and their results are presented in Table 6. In the physical environment category, having a clean neighborhood with well-maintained streets and the general appearance of buildings in the neighborhood ranked highest. The most important features for participants in the transportation category were special transportation options and conveniently located public parking lots that include parking for people with disabilities. In terms of accessibility, having access to affordable delivery systems and access to downtown within 20-minute driving distance were the most favorable attributes. Finally, having clean air and a low rate of crime; having nice neighbors and a neighborhood where people are willing to help each other whenever necessary had the highest scores in the wellbeing and community values group.

Question	When you think about a place to live how important is it to you to have the following features in the neighborhood?					
Groups	**Variable**	**Scale**	**N**	**%**	**Mean**	**SD**
Physical Environment	Well maintained streets	Not important	4	1.4	1.99	.117
		Important	281	98.6		
		Missing	0	0		
	Low density	Not important	66	23.2	1.77	.423
		Important	218	76.5		
		Missing	0	0		
	Enough benches for resting in public areas, along sidewalks, and around public buildings	Not important	53	18.6	1.81	.389
		Important	232	81.4		
		Missing	0	0		
	The general appearance of buildings in the neighborhood and clean neighborhood	Not important	7	2.5	1.97	.155
		Important	278	97.5		
		Missing	0	0		
	Parks and green spaces	Not important	11	3.9	1.96	.193
		Important	273	95.8		
		Missing	1	0.4		
	Public buildings and spaces that are accessible to people of different physical abilities	Not important	30	10.5	1.89	.307
		Important	255	89.5		
		Missing	0	0		
Transportation	Bus routes	Not important	120	42.1	1.57	.494
		Important	164	57.5		
		Missing	1	0.4		
	Bicycle facilities	Not important	140	49.1	1.50	.500
		Important	145	50.9		
		Missing	0	0		
	Public transportation	Not important	93	32.6	1.67	.470
		Important	191	67		
		Missing	1	0.4		
	Close to major roads	Not important	86	30.2	1.69	.459
		Important	199	96.8		
		Missing	0	0		
	Special transportation options for the elderly and people with disability	Not important	45	15.8	1.84	.365
		Important	239	83.9		
		Missing	1	0.4		
	Conveniently located public parking lots including parking for people with disabilities	Not important	56	19.6	1.80	.398
		Important	229	80.4		
		Missing	0	0		

Access to Amenities	Homes of friends and relatives within walking distance	Not important	108	37.9	1.62	.485
		Important	177	62.1		
		Missing	0	0		
	Recreation facilities within walking distance	Not important	80	28.1		
		Important	205	71.9	1.71	.450
		Missing	0	0		
	Grocery stores within walking distance	Not important	81	28.4		
		Important	203	71.2	1.71	.452
		Missing	1	0.4		
	Cultural offerings and activities within walking distance	Not important	103	36.1		
		Important	182	63.9	1.64	.481
		Missing	0	0		
	Religious centers (Church, mosque, synagogue, …)	Not important	148	51.9		
		Important	137	48.1	1.48	.500
		Missing	0	0		
	Access to downtown/city center within 20-minute driving distance	Not important	44	15.4		
		Important	241	84.6	1.84	.361
		Missing	0	0		
	Access to the workplace within 10-minute driving distance	Not important	139	48.8		
		Important	146	51.2	1.51	.500
		Missing	0	0		
	Doctor, pharmacy, and emergency care centers within walking distance	Not important	123	43.2		
		Important	162	56.8	1.56	.496
		Missing	0	0		
	Access to places where older people can go for advice and support (e.g. senior center)	Not important	72	25.3		
		Important	212	74.4	1.74	.435
		Missing	1	0.4		
	Access to social clubs such as book, gardening, craft or hobby within walking distance	Not important	108	37.9		
		Important	176	61.8	1.62	.486
		Missing	1	0.4		
	Affordable delivery system	Not important	47	16.5		
		Important	238	83.5	1.83	.371
		Missing	0	0		
Well-being, Safety, and Security	Low noise level and Calm	Not important	14	4.9		
		Important	271	95.1	1.95	.216
		Missing	0	0		
	Clean air	Not important	2	0.7		
		Important	283	99.3	1.99	.083
		Missing	0	0		
	Little crime	Not important	1	4		
		Important	284	99.6	1.99	.060
		Missing	0	0		

	Reduced (15-25 mph) speed limits for cars	Not important Important Missing	27 256 2	9.5 89.8 0.7	1.90	.294
	Low traffic intensity	Not important Important Missing	14 268 3	4.9 94 1.1	1.95	.217
	Safe public transportation stops or areas that are accessible to people of varying physical abilities	Not important Important Missing	56 229 0	19.6 80.4 0	1.80	.398
	Sidewalks that are in good condition and accessible for wheelchairs or other assistive mobility devices	Not important Important Missing	17 268 0	6 94 0	1.94	.237
	Safe crossings that have both audio and visual signals	Not important Important Missing	34 251 0	11.9 88.1 0	1.88	.324
	Separate pathways for bicyclists and pedestrians	Not important Important Missing	49 235 1	17.2 82.5 0.4	1.82	.378
	Having an emergency shelter within walking distance (For tornado, flood, …)	Not important Important Missing	71 214 0	24.9 75.1 0	1.75	.433
Community Values	High Social status	Not important Important Missing	212 72 1	74.4 25.3 0.4	1.25	.435
	Having the opportunity to participate in decision making bodies such as community councils or committees	Not important Important Missing	71 214 0	24.9 75.1 0	1.75	.433
	Nice neighbors	Not important Important Missing	11 274 0	3.9 96.1 0	1.96	.192
	Racial/Ethnic diversity of the neighborhood	Not important Important Missing	61 224 0	21.4 78.6 0	1.78	.410
	No majority of immigrants in the neighborhood	Not important Important Missing	236 47 2	82.8 16.5 0.7	1.16	.372

Majority of people from the same race/ethnicity as you in the neighborhood	Not important Important Missing	245 40 0	86 14 0	1.14	.347
A neighborhood where people know each other	Not important Important Missing	30 255 0	10.5 89.5 0	1.89	.307
A feeling of belonging to the neighborhood	Not important Important Missing	34 251 0	11.9 88.1 0	1.88	.324
A neighborhood where people have respect for older people	Not important Important Missing	14 271 0	4.9 95.1 0	1.95	.216
A neighborhood where people are willing to help each other whenever necessary	Not important Important Missing	12 273 0	4.2 95.8 0	1.95	.201
Shared religious beliefs.	Not important Important Missing	257 28 0	90.2 9.8 0	1.98	.298

Table 6: Results for analyzing the Likert scale questions

Comparing the preferences of two groups

Physical Environment

The results of the Mann-Whitney test did not show many differences between the preferences of middle-aged and older adults regarding 5 physical environment attributes (Table 7). However, at the 0.05 level, the results suggested that the general appearance of buildings in the neighborhood and having a clean neighborhood ranked higher for individuals 65 and older compared to the middle-aged group ($p = .015$). These neighborhood attributes were mentioned by several respondents in the survey as well. In one of the questions, participants were asked "What do you like the most about your current neighborhood?" and individuals used the following terms to describe their neighborhood: "nice and clean", "clean", "architecture and trees", "older homes with large trees", "nice yards with big trees", "old houses", "properties look

nice", "houses are well kept", "pretty", "well maintained homes", "wonderful older homes", "physically attractive", and "cleanliness and beauty".

Attributes	Mann-Whitney U	Std. Error	Z Score	Sig.[a,b]	Mean Rank for Age 50-64	Mean Rank for Age 65 and above
P1. Well maintained streets.	10152	141.74	-.007	.994	143	142
P2. Low density.	10653	511.23	.979	.328	139	146
P3. Enough benches for resting in public areas, along sidewalks, and public buildings.	10781	468.82	1.340	.180	138	147
P4. The general appearance of buildings in the neighborhood and clean neighborhood.	11583	589.74	2.425	.015	133	153
P5. Parks and green spaces.	10433	242.00	1.157	.247	141	145
P6. Public buildings and spaces that are accessible to people of different physical abilities.	10715	369.79	1.521	.128	139	147

a. The significance level is .050.
b. Asymptotic significance is displayed.

Table 7: Mann-Whitney U test results for the physical environment category

Transportation

In the transportation category, the Mann-Whitney test showed that the distribution of T1 to T6 was the same across both age groups. This means that there was no significant difference between their preferences. The results of the Mann-Whitney test including the standard error, Z score, and P-value for the test are presented in Table 8. The presence of special transportation options and parking lots for people with disabilities and older individuals in the neighborhood were the most important attributes for both age groups. Participants declared the importance of these attributes by using terms like: "easy access to highway", "Close to I-35", "close to major roads", "easy access to highway", and "access to highway".

Attributes	Mann-Whitney U	Std. Error	Z Score	Sig.[a,b]	Mean Rank for Age 50-64	Mean Rank for Age 65 and above
T1. Bus routes	10367	596.34	.360	.719	142	144
T2. Bicycle facilities	9405	602.38	-1.241	.215	148	138
T3. Public transportation	9820	566.99	-.587	.557	145	141
T4. Close to major roads	9846	553.09	-.554	.579	145	141
T5. Special transportation options for the elderly and people with disability	10296	443.45	.322	.747	142	144
T6. Conveniently located public parking lots including parking for people with disabilities	10139	478.78	-.029	.977	143	143

a. The significance level is .050.
b. Asymptotic significance is displayed.

Table 8: Mann-Whitney U test results for the transportation category

Access to Amenities

Access to the workplace within 10-minute driving distance; and access to doctor, pharmacy, and emergency care centers within walking distance were the attributes that scored differently across the age categories. The result of the Mann-Whitney U test showed that access to workplace was more important for individuals aged 65 and older with the p value of .045 while the 50–64-year-old group values access to pharmacies and medical centers more than the other group (p = <.001) (Table 9). Related terms to this category used by survey participants when they were asked about their favorite neighborhood features were “close to many businesses”, “location”, “close to Walmart”, “close to shopping”, “walking distance to everything except a grocery”, “access to parks”, “Close proximity to everything”, “proximity to services”, stores and restaurants”, “Near to park, library, store & restaurants”, “ restaurants,

shops, library, post office, doctors, pharmacy and hospital within walking distance", "close to shopping and services", "proximity to gas station, grocery stores, fast food, and essentials shopping", "close to bank, groceries, shopping, entertainment, restaurants", "close to my son", "easy access to essentials", "I'm a block from a grocery store and a pharmacy", "Convenience to shopping and library", and "Proximity (walking or bicycling distance) to grocery/pharmacy, public and university libraries/events, public parks".

Attributes	Mann-Whitney U	Std. Error	Z Score	Sig.[a,b]	Mean Rank for Age 50-64	Mean Rank for Age 65 and above
A1. Homes of friends and relatives within walking distance.	9500	439.37	-1.485	.138	147	139
A2. Recreation facilities within walking distance.	10268	584.55	.198	.843	143	143
A3. Grocery stores within walking distance.	10845	541.43	1.279	.201	138	148
A4. Cultural offerings and activities within walking distance.	10112	545.86	-.075	.940	143	143
A5. Religious centers.	10768	578.86	1.063	.288	139	147
A6. Access to downtown/city center within 20-minute driving distance.	10971	602.02	1.359	.174	137	149
A7. Access to the workplace within 10-minute driving distance.	11436	638.77	2.009	.045	134	152
A8. Doctor, pharmacy, and emergency care centers within walking distance.	7930	666.85	-3.334	<.001	158	127
A9. Access to places where older people can go for advice and support (e.g. senior center).	9481	596.81	-1.126	.260	147	138
A10. Access to social clubs such as book, gardening, craft or hobby within walking distance.	10939	526.27	1.494	.135	137	148
A11. Affordable delivery system.	10653	586.22	.854	.393	140	146

a. The significance level is .050.
b. Asymptotic significance is displayed.

Table 9: Mann-Whitney U test results for the access to amenities category

Well-being, Safety, and Security

In the well-being and safety category, one attribute scored differently across the age groups after conducting the Mann-Whitney U test. Safe crossings that have both audio and visual signals with the P-value= .030 were more appreciated for individuals aged 65 or older than the younger group. When participants were asked what features they would like to change about their neighborhood many of them mentioned the lack of sidewalks, high crime rate, and high traffic intensity.

Attributes	Mann-Whitney U	Std. Error	Z Score	Sig.[a,b]	Mean Rank for Age 50-64	Mean Rank for Age 65 and above
W1. Low noise level and Calm.	10149	260.42	-.013	.989	143	143
W2. Clean air.	10152	100.58	-.005	.996	143	143
W3. Little crime.	10224	71.25	.996	.319	143	143
W4. Reduced (15-25 mph) speed limits for cars.	10059	364.42	-.257	.798	143	143
W5. Low traffic intensity.	10504	285.45	1.231	.218	140	146
W6. Safe public transportation stops or areas that are accessible to people of varying physical abilities.	10566	478.78	2.337	.388	140	146
W7. Sidewalks that are in good condition and accessible for wheelchairs or other assistive mobility devices.	10505	285.37	1.233	.217	140	146
W8. Safe crossings that have both audio and visual signals.	10999	390.57	2.167	.030	137	149
W9. Separate pathways for bicyclists and pedestrians.	10439	458.46	.624	.533	141	145
W10. Having an emergency shelter within walking distance (For tornado, flood, …).	10491	521.15	.650	.516	141	145

a. The significance level is .050.
b. Asymptotic significance is displayed.

Table 10: Mann-Whitney U test results for the well-being, safety, and security category

Community Values

This category had the highest number of attributes that were prioritized differently across the age groups. Living in a neighborhood with high social status, having the opportunity to participate in decision-making bodies such as community councils or committees, no majority of immigrants in the neighborhood, most people from the same race/ethnicity in the neighborhood, and shared religious beliefs were the attributes that were preferred more among participants aged 65 or older. When participants were asked what they don't like about their neighborhood, 7 of them mentioned they prefer fewer rental units in their neighborhood so they could know their neighbors better.

Attributes	Mann-Whitney U	Std. Error	Z Score	Sig.[a,b]	Mean Rank for Age 50-64	Mean Rank for Age 65 and above
C1. High social status.	11368	526.27	2.310	.021	134	152
C2. Having the opportunity to participate in decision-making bodies such as community councils or committees.	11346	521.15	2.290	.022	134	152
C3. Nice neighbors.	9936	232.11	-.933	.351	145	141
C4. Racial/Ethnic diversity of the neighborhood.	10351	494.21	.402	.688	141	145
C5. No majority of immigrants in the neighborhood.	11360	454.97	2.654	.008	134	152
C6. The majority of people from the same race/ethnicity as you in the neighborhood.	11018	418.54	2.067	.039	136	150
C7. A neighborhood where people know each other.	9860	369.79	-.791	.429	145	141
C8. A feeling of belonging to the neighborhood.	10002	390.57	-.387	.699	145	141
C9. A neighborhood where people have respect for older people.	10577	260.42	1.628	.103	141	145

C10. A neighborhood where people are willing to help each other whenever necessary.	10435	241.99	1.165	.244	141	145
C11. Shared religious beliefs.	10872	358.65	2.006	.045	138	148

a. The significance level is .050.
b. Asymptotic significance is displayed.

Table 11: Mann-Whitney U test results for the community values category

Spatial Analysis Results

Kernel Density

After mapping the location of participants and services, the kernel density tool in ArcMap was used to create heat maps. Kernel Density Estimation (KDE) is essentially a method for estimating density, primarily relying on a distance-based approach to analyze a dataset consisting of points. It results in the generation of a density surface for each individual point within the dataset. For each specific point, a kernel density surface is constructed with its peak value located at the center of that point's position. As you move away from this center, the density value gradually diminishes until it eventually reaches zero once it extends beyond a predetermined radius. Conceptually, all of these individual density surfaces are combined to form a continuous and smoothly curved surface that spans across the entire study area (Silverman 1986).

The following kernel density maps visualize the concentration of the services in the neighborhoods. These maps show that the amenities are not distributed equally in the city, and the majority of them are located in small areas in the west side of the city, leaving the rest of the city's residents with no access within walking distance to these services. As shown in Figure 15, the current public transportation system does not cover the whole city either and is insufficient to

support the city's residents. Therefore, these services are mainly catering to the individuals that can drive or are being driven by somebody else to access them.

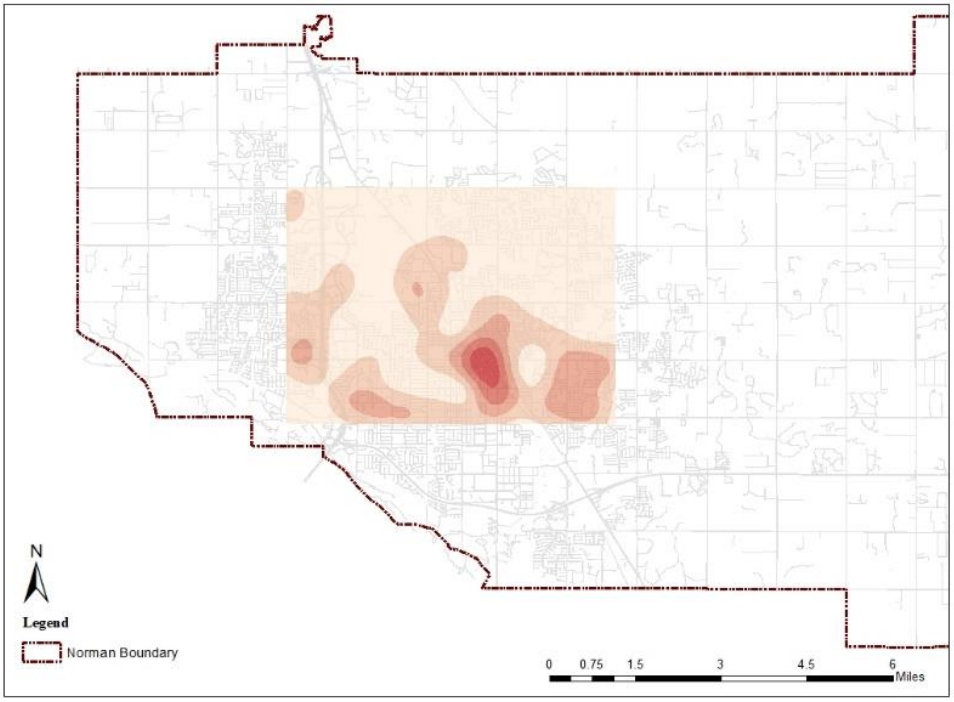

Figure 16: Kernel density map of bus stops

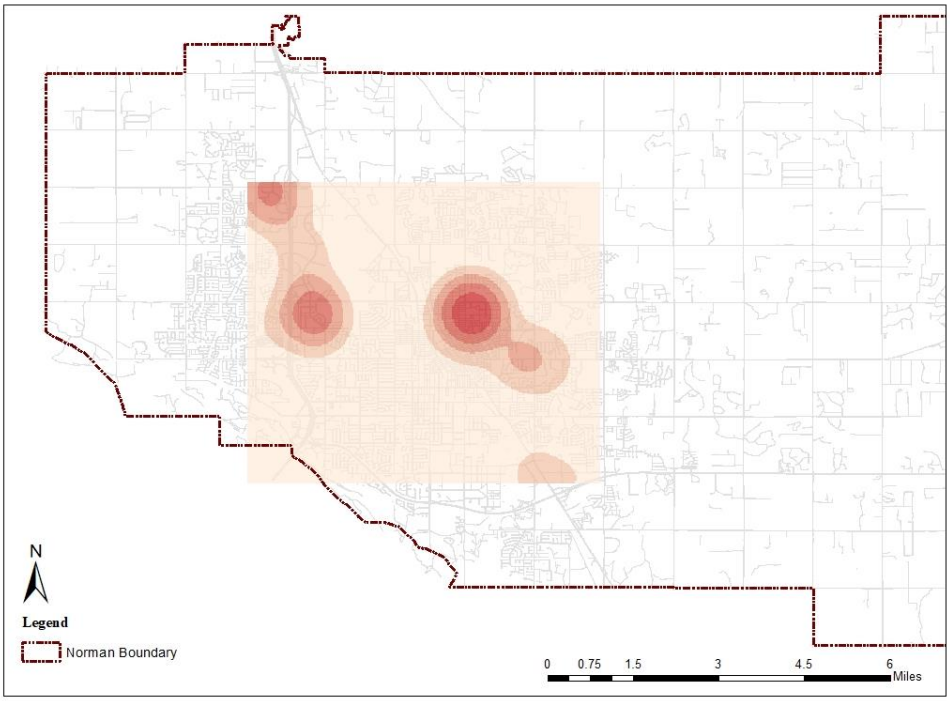

Figure 17: Kernel density map of medical centers

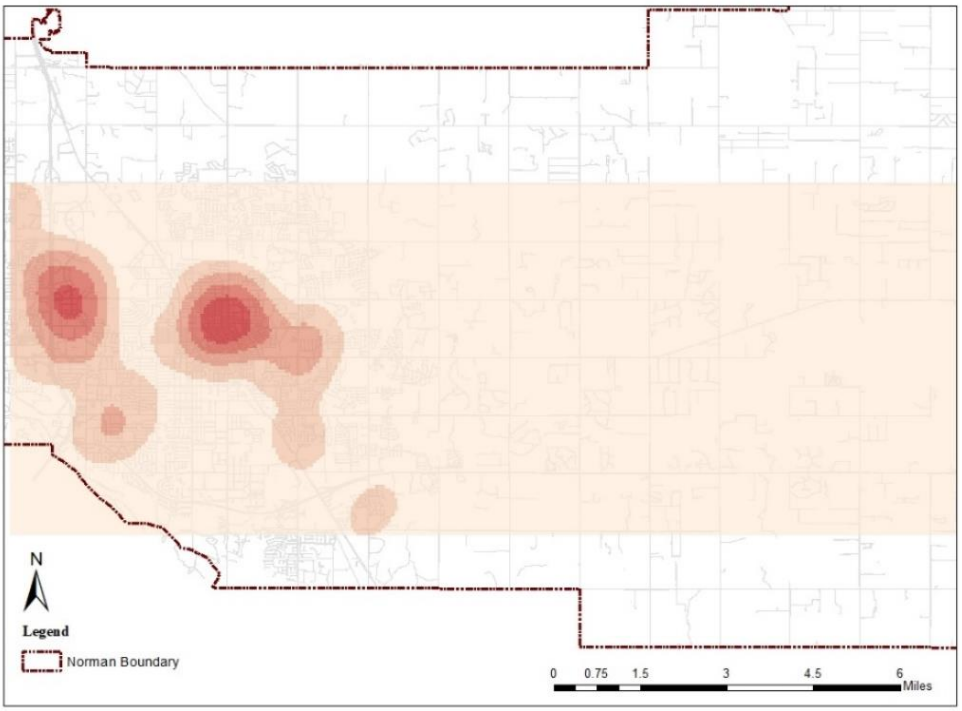

Figure 18: Kernel density map of pharmacies

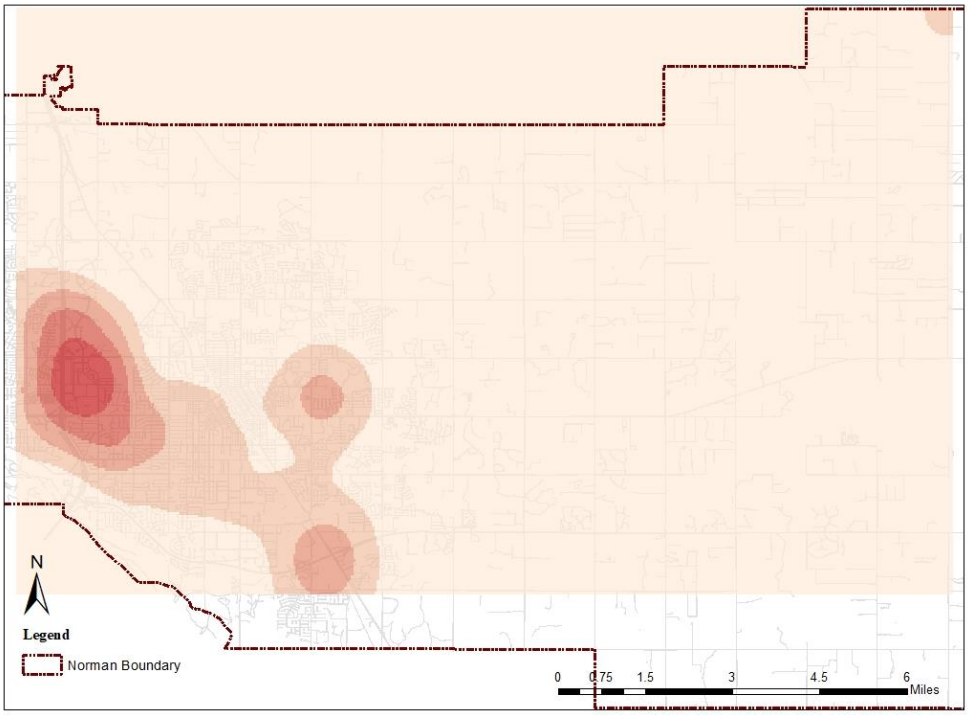

Figure 19: Kernel density map of grocery stores

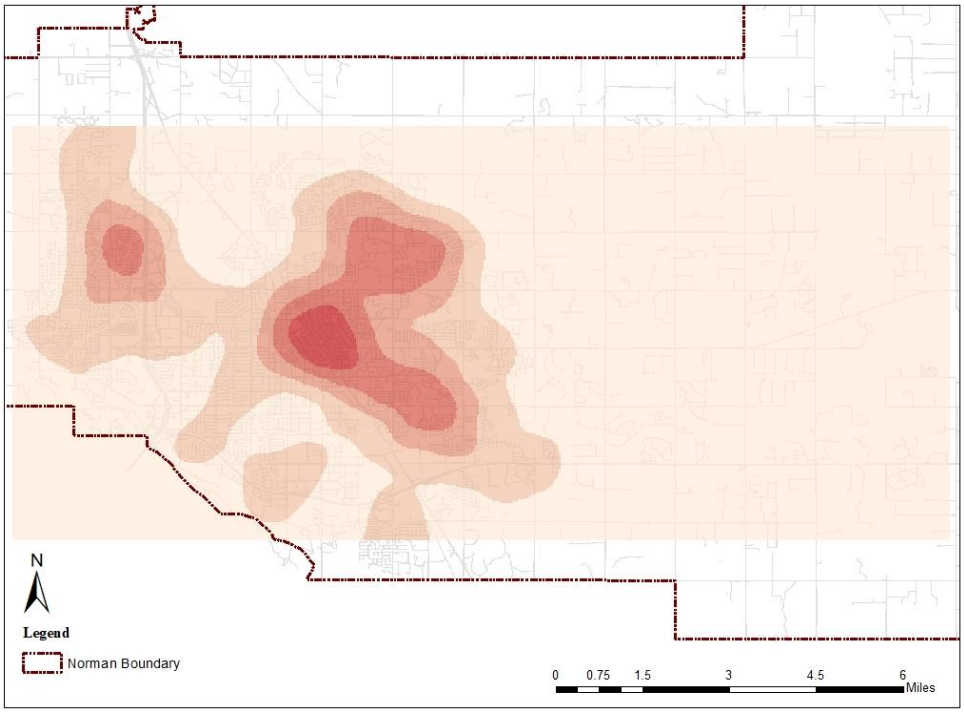

Figure 20: Kernel density map of parks

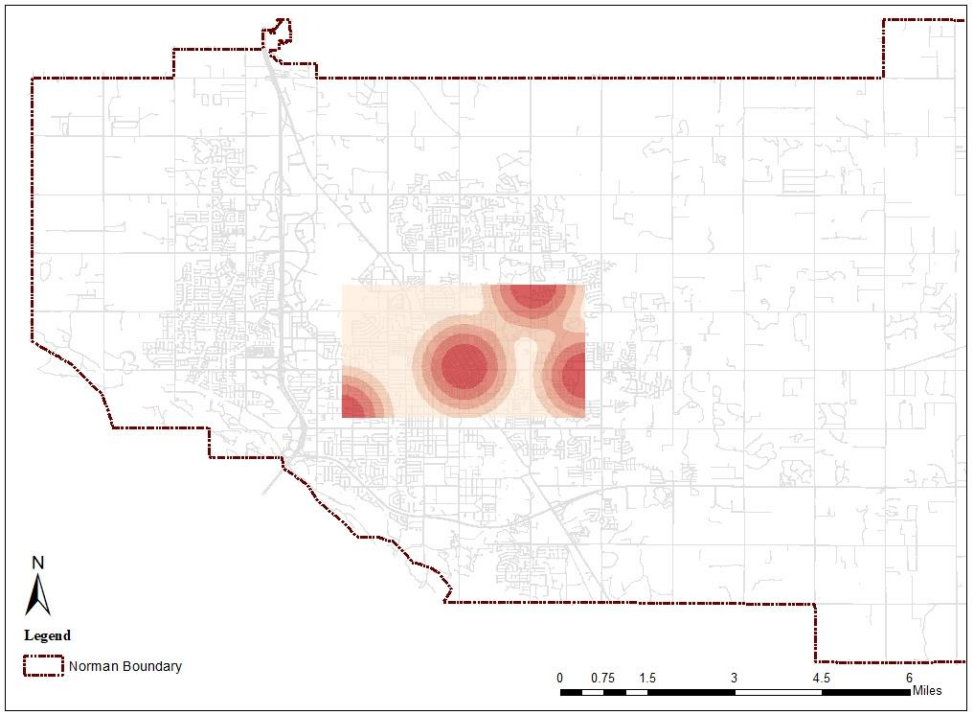

Figure 21: Kernel density map of recreation centers

Available Neighborhood Services Within Walking Distance

After counting the number of bus stops, Grocery stores, medical centers, pharmacies, parks, and recreation centers within the 0.25-mile and 0.5-mile radius around each intersection, mean, median, range, and standard deviation were calculated for these services. As the results show in Table 12 the number of recreation centers and grocery stores are the lowest in both buffer distances.

Total		Bus Stops	Grocery Stores	Medical Centers	Pharmacies	Parks	Recreation Centers
Within 0.25 M	Mean	1.05	.14	.21	.22	.37	.05
	Median	0	0	0	0	0	0
	Range	9	1	5	3	2	1
	SD	1.581	.343	.620	.516	.551	.227
Within 0.5 M	Mean	4.03	.34	.81	.75	1.63	.17
	Median	3	0	0	0	1	0
	Range	16	3	6	6	5	1
	SD	4.354	.582	1.41	1.14	1.295	.373

Table 12: Number of services within the 0.25- and 0.5-miles radius of studied intersections

Out of all the intersections, six were selected to visualize participants' access to amenities (Figure 21). These intersections were chosen because they had the highest/lowest number of participants and/or services around them. As shown in the following maps, the Lindsey and Highway 9 intersection has no services in either threshold. On the other hand, individuals living close to 12th and Alameda Street; as well as near the intersection of 36th and Main Street have access to many services. However, many of these intersections have no sidewalks or the

sidewalks are poorly connected around them which make it difficult for anybody to be able to access these services without relying on a car.

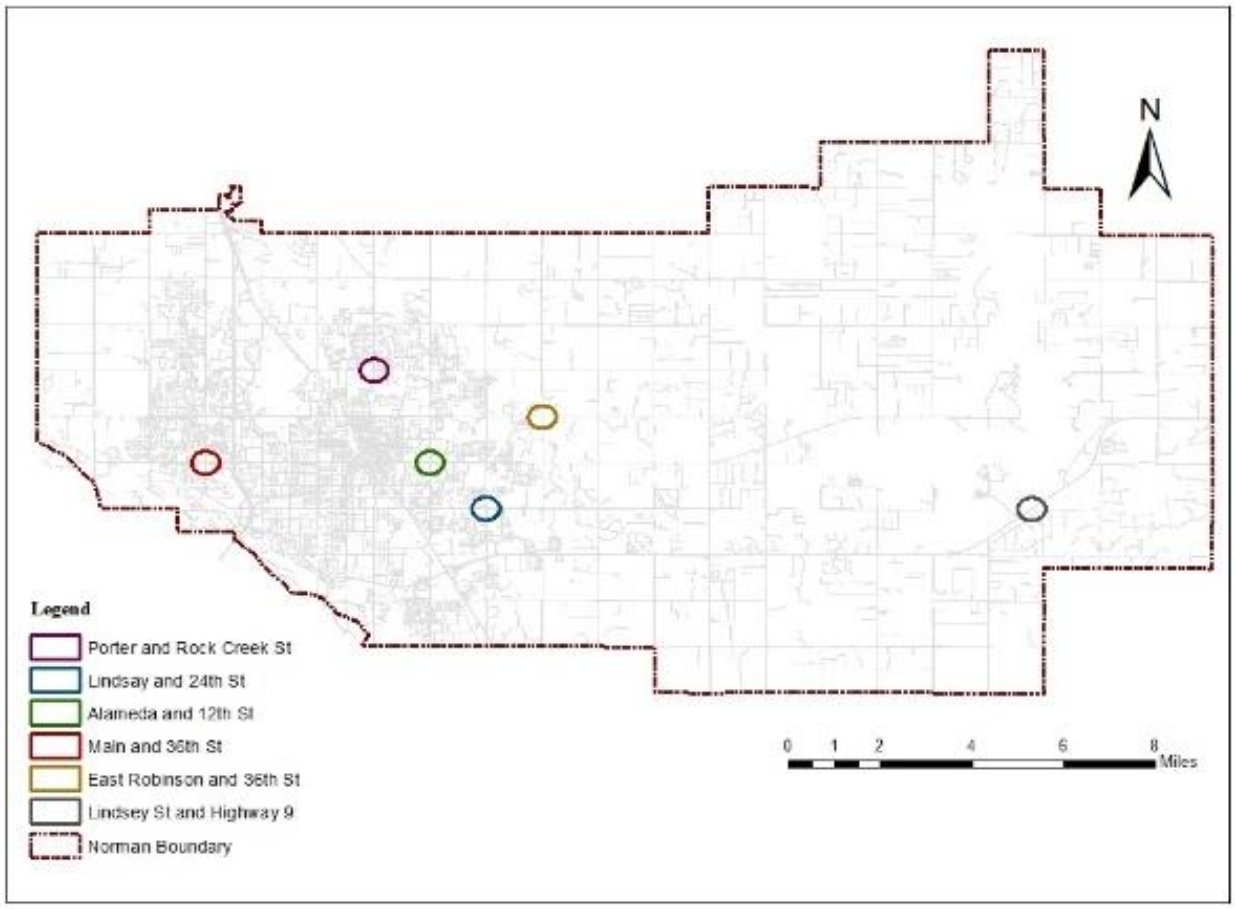

Figure 22: Location of selected intersections

Figure 23: Lindsey Street and Highway9 intersection

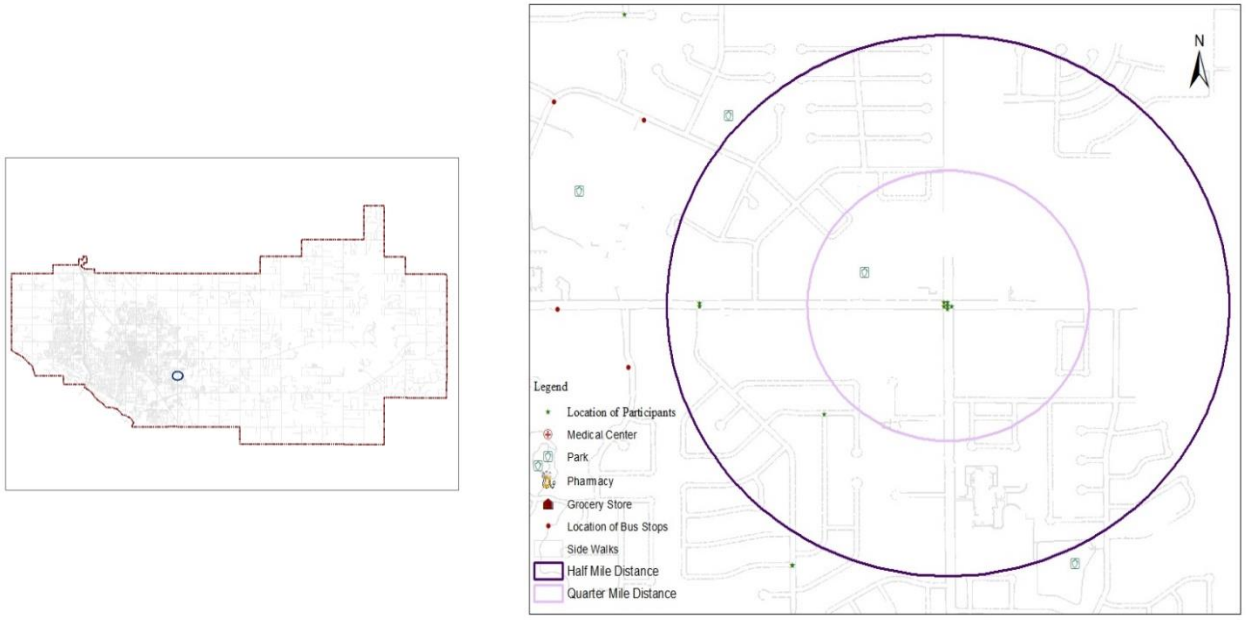

Figure 24: 24th and E Lindsay Street intersection

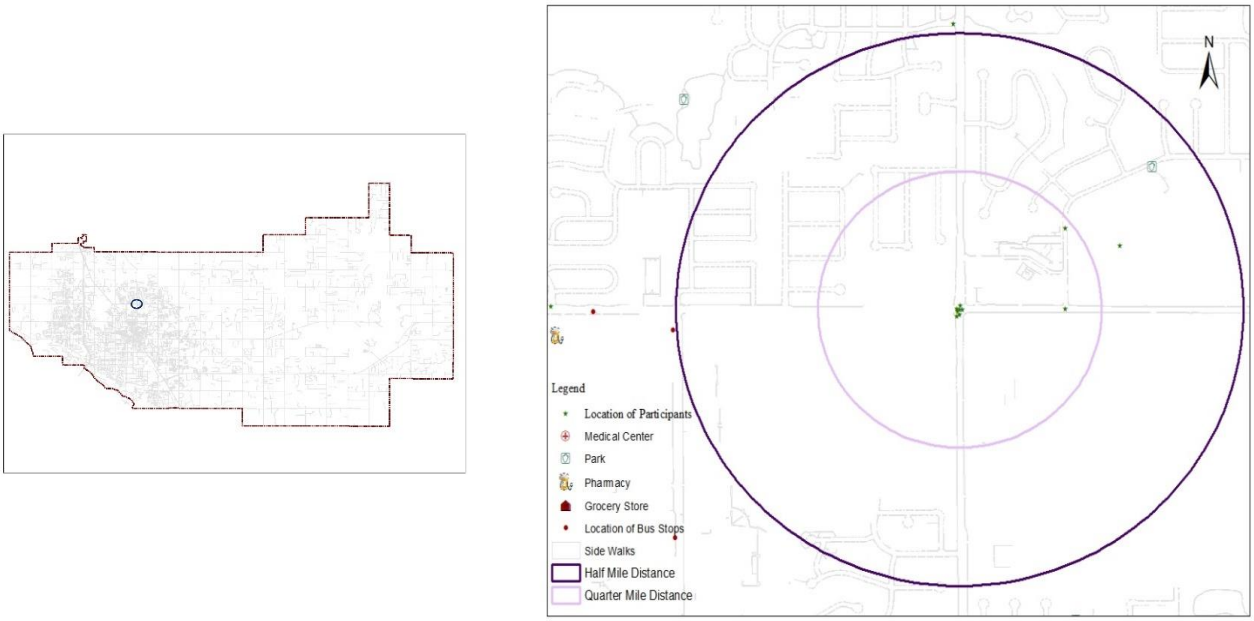

Figure 25: Porter Street and Rock Creek intersection

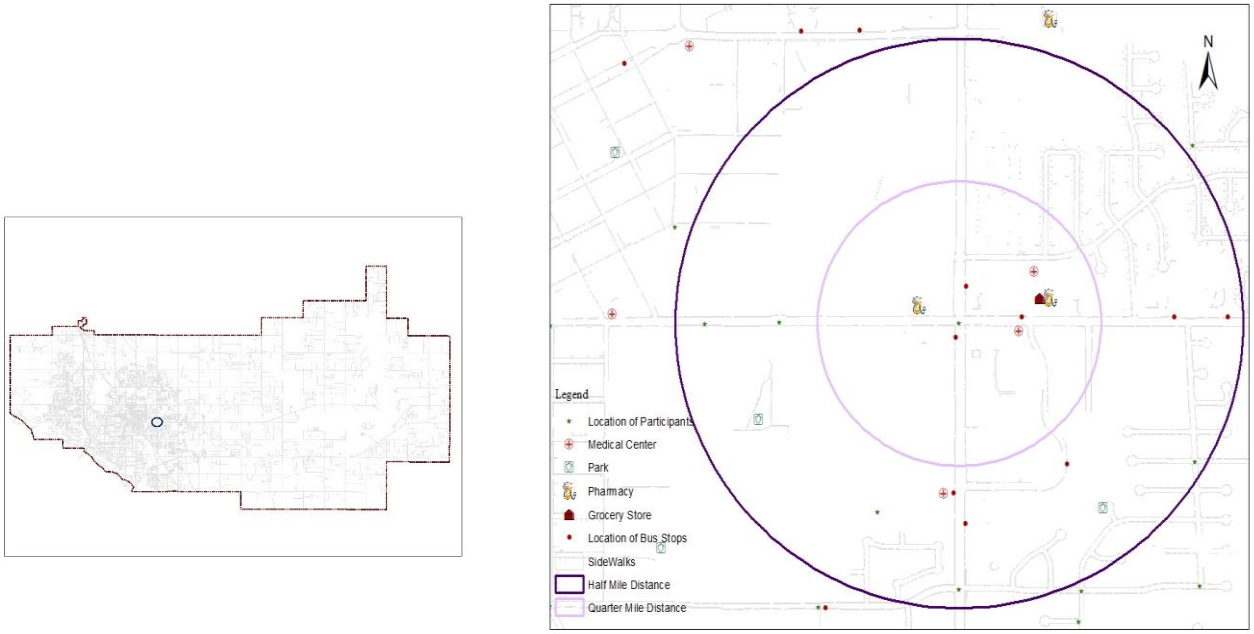

Figure 26: 12th Street and Alameda intersection

Figure 27: 36th Street and Main Street intersection

Figure 28: 36th St and East Robinson Street intersection

Summary of Results

To achieve the research objective, I answered the following questions through analyzing the survey data and spatial analysis:

1. What are the neighborhood attribute preferences of middle aged and older adults and how do they differ between these groups?

Based on the findings, important neighborhood attributes for both the younger and older adults are the general appearance of buildings in the neighborhood, clean neighborhood, having access to parks and green spaces, access to special transportation options for the elderly and people with disability, conveniently located public parking lots including parking for people with disabilities, homes of friends and relatives within walking distance, access to affordable delivery system, having little crime in the neighborhood, reduced (15-25 mph) speed limits for cars, living in a neighborhood where people have respect for older people, and most people from the same race/ethnicity in the neighborhood. Both groups stated that they need more accessible built environment and sidewalks in their neighborhoods.

Although both groups prefer similar neighborhood attributes, the Mann-Whitney test results show that neighborhood attributes like the general appearance of buildings in the neighborhood, access to the workplace within 10-minute driving distance, safe crossings that have both audio and visual signals, living in a neighborhood with high social status, having the opportunity to participate in decision making bodies such as community councils or committees, no majority of immigrants in the neighborhood, most people from the same race/ethnicity in the neighborhood, and shared religious beliefs are more important to individuals aged 65 or older. However, the younger group value features like having access to doctors, pharmacy, and emergency care centers within walking distance. Conducting the MWU test for other variables

indicated that variables like income and race impact the neighborhood attribute preferences of participants more than other variables. Results are presented in the following table.

Variables	Categories	
Age	**50- 64 Years Old**	**65 Years Old and Over**
	➢ Access to doctor, pharmacy, and emergency care centers within walking distance	➢ The general appearance of buildings in the neighborhood ➢ Clean neighborhood ➢ Access to the workplace within 10-minute driving distance ➢ Safe crossings that have both audio and visual signals ➢ Living in a neighborhood with high social statues ➢ Having the opportunity to participate in decision making bodies such as community councils or committees ➢ No majority of immigrants in the neighborhood ➢ Most people from the same race/ethnicity in the neighborhood ➢ Shared religious beliefs
Disability	**Someone with Disability in the Household**	**Nobody with Disability in the Household**
	➢ Enough benches for resting in public areas, along sidewalks, and around public buildings	➢ Having access to bicycle facilities
Income	**Less than 60000 a Year**	**More than 60000 a Year**
	➢ Enough benches for resting in public areas, along sidewalks, and around public buildings	➢ Public buildings and spaces that are accessible to people of different physical abilities ➢ Access to bus routes ➢ Access to public transportation ➢ Special transportation options for the elderly and people with disability ➢ Homes of friends and relatives within walking distance ➢ Doctor, pharmacy, and emergency care centers within walking distance

		➢ Access to places where older people can go for advice and support (e.g. senior center) ➢ Access to social clubs such as book, gardening, craft or hobby within walking distance ➢ Affordable delivery system ➢ Safe public transportation stops or areas that are accessible to people of varying physical abilities ➢ Sidewalks that are in good condition and accessible for wheelchairs or other assistive mobility devices ➢ Safe crossings that have both audio and visual signals ➢ Having an emergency shelter within walking distance (For tornado, flood, …)
	White	**Non-white**
Race	➢ Access to bicycle facilities ➢ Close to major roads ➢ Recreation facilities within walking distance ➢ Having the opportunity to participate in decision making bodies such as community councils or committees	
	Less than 15 Years	**16 Years and More**
Length of Living in the Neighborhood	➢ A neighborhood where people have respect for older people ➢ A neighborhood where people are willing to help each other whenever necessary	

Table 13: Differences between the neighborhood attribute preferences based on other independent variables

2. What is the spatial distribution of amenities in these individuals' neighborhoods and their access?

The spatial analysis indicated that currently individuals aged 50 and above do not have access to services like public transportation, food stores, medical centers, pharmacies, parks, and recreational centers within walking distance. These services and amenities are not distributed equally in the city either. The majority of them are located in a small area on the west side of the city and mainly catering to those living close to them.

3. What are the mismatches between preferred and current neighborhood attributes of the targeted groups?

Although most of the study participants prefer to age in their own neighborhoods and have access to age friendly services, spatial analysis of amenities near participants' residencies indicated that currently these individuals don't have ideal access to services like public transportation, food stores, medical centers, pharmacies, parks, and recreational centers that support aging in place. Most of these amenities are located on the west side of the city in a small area. Also, the built environment form in Norman, like many other cities in the U.S. is very car oriented and physically disconnected from services. Therefore, these amenities are neither accessible for pedestrians due to the lack or poor condition of sidewalks, nor for those using public transportation with its limited coverage.

Chapter 5: Discussion, Limitations and Contributions

Discussion

Over the past two decades there has been more collaboration between designers, public health providers, and policy makers to make communities more age-friendly (Fitzgerald and Caro 2014; Greenfield et al. 2015). A variety of factors including global urbanization and the aging population across the globe and the impact of these changes on cities have sparked discussion around this subject. As the World Health Organization (2007) stated the world's population is rapidly aging, and the proportion of individuals aged 60 and over will double from 11% in 2006 to 22% by 2050. At the same time, the number and proportion of urban dwellers is rising and 3 out of 5 people in the world will live in the cities by 2030. Faced with this dramatic change in the world's population, the idea of aging in place and the age friendly community initiatives were proposed by the WHO to focus on making the older adults' home and communities safe and tailored to their well-being and needs.

By aging in place, older individuals can remain in their homes and communities for as long as possible while maintaining their autonomy and connection to their social network like friends and family (Fitzgerald and Caro 2014; Wiles et al. 2012; World Health Organization 2007; Lawler 2001). Aging in place is also economically beneficial since individuals avoid the costly option of institutional care (Curioni et al. 2023; World Health Organization 2023b). Today, much of the older population in the US is dealing with health issues which makes aging in place more challenging for communities (Lakdawalla, Goldman, and Shang 2005; Association 2013; Mildred E. Warner, Xu, and Morken 2017).

To understand aging in place and challenges that older adults face to remain in their neighborhoods as they age, in this dissertation by conducting a survey I explored the

neighborhood preferences of middle-aged groups and compare them with older adults in Norman, Oklahoma. Out of 285 individuals that participated in the survey, 143 individuals were aged 50-64 (50.2%), and 142 of them were 65 or older (49.8%). These individuals consisted of 229 (80.4%) women and 56 men (19.6%). Most respondents were white or Caucasian (90.9%). The survey also collected information about these individuals' disabilities, and 132 (45.6%) of them declared themselves or someone in their home has disability. Furthermore, I collected information about participation's location by asking about the nearest intersection to the participants homes in the survey.

After analyzing the survey results and finding the nearest intersections to the participants, I pinpointed these intersections on Google Earth. I gathered data regarding age-friendly neighborhood services through sources such as The City of Norman's website and Google search engine. These amenities were categorized into four groups: transportation (T), nutrition (N), medical care (MC), and recreation (R). These attributes were extracted from both Table 3 and the survey responses.

In the nutrition category, I found a list of existing grocery stores and their addresses. Under medical care, all medical centers and pharmacies were identified. For the recreation category, parks and recreation centers within the city's boundary were located through Google search. Lastly for the transportation category, I compiled the lists of existing bus stops and routes through the City of Norman Transportation Website, Embark. Once the addresses of these facilities were discovered, I pinpointed their coordinates on Google Earth. Afterwards, the data from Google Earth was stored as a KML layer, which was then imported into ArcMap for analysis. Lastly, I downloaded data on sidewalks, and the city's boundary from the GIS Services Division on the City of Norman's website.

The survey results proved that 83.5% of participants (N=238) prefer to remain in their neighborhoods as they age. Based on the findings important neighborhood attributes for both the younger and older adults are the general appearance of buildings in the neighborhood, clean neighborhood, having access to parks and green spaces, access to special transportation options for the elderly and people with disability, conveniently located public parking lots including parking for people with disabilities, homes of friends and relatives within walking distance, access to affordable delivery system, having little crime in the neighborhood, reduced (15-25 mph) speed limits for cars, and living in a neighborhood where people have respect for older people.

Although both groups prefer similar neighborhood attributes, results indicate that the older group are more car oriented and they value access to amenities and services within driving distance. On the other hand, the younger group (aged 50-64) prefer having access to neighborhood services withing walking distance. Research studies have proven that walkable built environments and accessible sidewalks affect the level of physical activity in older adults and their well-being (Balfour and Kaplan 2002; Berke et al. 2007; McCormack, Giles-Corti, and Bulsara 2008; Van Dyck et al. 2012; Mildred E. Warner, Xu, and Morken 2017; Bozovic, Hinckson, and Smith 2020; Gan et al. 2021; Jardim and de Castro Neto 2022). Sidewalks also impact the participation of people with disabilities in their community (Ferleger 2012).

Based on the findings, there are more individuals with disability among the 50 to 64 age group than the older groups in Norman. In one of the survey questions participants were asked what they don't like about their current neighborhood and the number one issue for many of them is the lack or low quality of sidewalks. It is not surprising that out of 285 participants in this study only 3 participants walk to travel to appointments, errands, events, or other locations. The

current quality of sidewalks in Norman and the fact that even younger adults are dealing with disabilities highlight the importance of planning and designing well maintained and safe sidewalks in the current and future neighborhoods of the city.

Based on analysis of the survey findings and spatial analysis of services in Norman there are mismatches between what individuals aged 50 and above prefer to have in their neighborhoods and the current situation. Although most of the study participants prefer to age in their own neighborhoods and have access to age friendly services, spatial analysis of amenities near participants' residencies indicated that currently these individuals don't have ideal access to services like public transportation, food stores, medical centers, pharmacies, parks, and recreational centers that support aging in place. Most of these amenities are located on the west side of the city in a small area. Also, the built environment form in Norman, like many other cities in the US, is very car oriented and physically disconnected from services. Therefore, these amenities are neither accessible for pedestrians due to the lack or poor condition of sidewalks nor for those using public transportation with its limited coverage.

Successful aging in communities is not possible without access to reliable transportation, health services, recreational opportunities, physical and social support systems, and a wide variety of amenities (Alley et al. 2007; Wiles et al. 2012; Fitzgerald and Caro 2014). As individuals grow older, their physical or cognitive abilities may diminish, requiring them to seek extra assistance to maintain their independence. For those aging while coping with a disability, their capacity to perform everyday tasks and engage in community activities frequently relies on the availability of accessible infrastructure and social support systems (Alley et al. 2007).

The urban sprawl of Norman has led its built environment in many neighborhoods to be automobile dependent and physically disconnected from retail, health services, and social

engagement opportunities for citizens as they age. In 2014, Ewing et al. found that compact planning design is negatively related to obesity, diabetes, and other chronic diseases at the county scale. However, as Warner, Xu, and Morken (2017) argue, achieving compact and walkable neighborhoods in many communities with low density "is not realistic or achievable". Therefore, when the built environment does not fully support individuals to age in place, effective planning can improve service provisions to bridge this gap. This is especially critical in the realm of transportation, where public transit and paratransit services work in conjunction with street design to enhance walkability, and mobility for senior citizens (Lynott, Fox-Grage, and Guzman 2013; Mildred E. Warner, Xu, and Morken 2017).

In order to make Norman more age friendly, it is crucial to supplement the physical design with services and amenities, such as accessible transportation, health care services, recreation and grocery stores with healthy and affordable food options. However, extending these services requires significant funds from private and public sources. (M. E. Warner and Homsy 2015). As we move toward making changes in these neighborhoods and distributing the resource equitably, nontraditional forms of planning practices like participatory planning can reduce citizens resistance to change and their willingness to pay from their private income (Smith 1973; Mouter 2021).

Limitations

Limitations existed in the recruiting method. In order to recruit participants, the survey link and recruiting flyer were posted on Facebook groups. However, not all individuals aged 50 or older are active on social media or have access to the internet. Distributing the hard copy version of the survey in places like churches, libraries, doctors' offices that these individuals are more likely to visit would have been beneficial.

Limitations also existed in the collected sample. Most participants in this study are white women. Research studies have proved that different groups like African Americans, Hispanics, Asians, and other minority groups live in communities and neighborhoods that are less age friendly compared to the white seniors. Future cross racial studies help to include these individuals' needs and preferences in planning age friendly neighborhoods. Also, this dissertation conducted a quantitative research study and adding a qualitative component like interview or photovoice will help the researcher to best understand the research problem (Creswell and Clark 2017). Finally, this study focusses on Norman, Oklahoma which is a small college town. Its size and location make the results more relevant to similar towns and cities and results cannot be generalized to larger cities since each city has its own unique built environment features.

Contributions

Aging in a familiar and safe environment leads to various physical, emotional, and psychological benefits for older individuals. By providing age friendly neighborhoods, these people can stay in their community, participate in social activities, and be physically active as they age. This study is the first project conducted on age friendliness of Norman, Oklahoma that examines and compares the preferences of older and younger adults in this city. It is also one of

the few studies in the planning field that combines quantitative analysis with spatial analysis to evaluate older adults' preferences and access to age friendly built environment attributes.

My findings contribute to the growing body of literature on efficient planning for the aging population by identifying the gap between what individuals aged 50 and above prefer and their current access to the built environment attributes and services that support aging in place. By comparing the younger and older adults' preferences and their demographic characteristics my findings indicate that the current middle-aged group are dealing more with disability and are less car oriented than the older generations. Although there are many projects and studies focused on the needs and preference of individuals age 65 or older as we look ahead the younger adults (age 50-64) are also important to think about since this group is planning for retirement and will become a major portion of the senior population in the near future. I believe my results will not only help younger and older citizens in their daily lives but will also guide planners and designers to recognize these individuals' daily challenges, needs, and preferences to consider in the design process. Thereby, this project could be a connection between researchers, designers, city planners, policy makers, and users to achieve built environments that support aging in place.

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Appendix A. Tables

Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Well maintained streets	133.22	218.649	.190	.903
Low density	133.81	219.483	.088	.905
Enough benches for resting in public areas, along sidewalks, and around public buildings	133.62	211.857	.445	.900
The general appearance of buildings in the neighborhood and clean neighborhood	133.17	218.391	.194	.903
Parks and green spaces	133.14	216.415	.315	.902
Public buildings and spaces that are accessible to people of different physical abilities	133.39	211.434	.486	.900
Bus routes	134.14	204.694	.598	.898
Bicycle facilities	134.28	211.618	.369	.901
Public transportation	133.91	204.167	.627	.898
Close to major roads	133.93	213.047	.397	.901
Special transportation options for the elderly and people with disability	133.55	206.771	.614	.898
Conveniently located public parking lots including parking for people with disabilities	133.59	207.139	.577	.898

Homes of friends and relatives within walking distance.	133.40	218.270	.117	.905
Recreation facilities within walking distance.	134.04	209.364	.511	.899
Grocery stores within walking distance.	133.81	210.045	.501	.900
Cultural offerings and activities within walking distance.	133.81	207.724	.557	.899
Religious centers.	133.98	208.141	.555	.899
Access to downtown/city center within 20-minute driving distance.	134.35	209.974	.382	.901
Access to the workplace within 10-minute driving distance.	133.58	212.222	.399	.901
Doctor, pharmacy, and emergency care centers within walking distance.	134.33	212.476	.289	.903
Access to places where older people can go for advice and support (e.g. senior center).	134.13	209.057	.506	.899
Access to social clubs such as book, gardening, craft or hobby within walking distance.	133.79	206.571	.578	.898
Affordable delivery system.	134.08	206.386	.598	.898
Low noise level and Calm.	133.55	208.547	.536	.899
Clean air.	133.16	218.033	.193	.903
Little crime.	132.90	219.277	.231	.903
Reduced (15-25 mph) speed limits for cars.	132.84	221.035	.098	.903
Low traffic intensity.	133.36	215.171	.321	.902

Safe public transportation stops or areas that are accessible to people of varying physical abilities.	133.33	216.991	.260	.902
Sidewalks that are in good condition and accessible for wheelchairs or other assistive mobility devices.	133.57	205.351	.658	.897
Safe crossings that have both audio and visual signals.	133.10	212.879	.486	.900
Separate pathways for bicyclists and pedestrians.	133.46	207.719	.611	.898
Having an emergency shelter within walking distance (For tornado, flood, …).	133.52	208.982	.521	.899
Low noise level and Calm.	133.67	207.252	.525	.899
High Social status.	134.68	218.553	.130	.904
Having the opportunity to participate in decision making bodies such as community councils or committees.	133.82	216.023	.240	.903
Nice neighbors.	133.15	217.873	.216	.903
Racial/Ethnic diversity of the neighborhood.	133.73	212.363	.358	.902
No majority of immigrants in the neighborhood.	135.01	218.813	.092	.905
Majority of people from the same race/ethnicity as you in the neighborhood.	135.10	220.349	.039	.906
A neighborhood where people know each other.	133.55	214.666	.341	.902
A feeling of belonging to the neighborhood.	133.51	212.139	.447	.900

A neighborhood where people have respect for older people.	133.17	211.662	.520	.900
A neighborhood where people are willing to help each other whenever necessary.	133.22	212.991	.477	.900
Shared religious beliefs.	135.27	216.639	.238	.903

Table 14: Cronbach's Alpha Reliability test

Location	Distance (Miles)	T	N	M		R	
		Bus Stops	Grocery Stores	Medical Centers	Pharmacies	Parks	Recreation Centers
12th Ave/Alameda	0.25 M	3	1	2	2	0	0
	0.5 M	8	1	3	2	2	0
12th Ave/Cedar Lane	0.25 M	0	1	0	0	0	0
	0.5 M	0	1	0	0	2	0
12th Ave/Golden Eagle	0.25 M	0	1	0	0	1	0
	0.5 M	0	1	0	0	2	0
12th Ave/Lindsey	0.25 M	2	0	0	1	1	0
	0.5 M	9	0	0	1	3	0
12th Ave NE/Robinson	0.25 M	0	0	0	0	0	0
	0.5 M	0	1	0	1	4	1
12th Ave SE/Cedar Lane	0.25 M	0	1	0	0	0	0
	0.5 M	0	1	0	0	2	0
12th SE St/East Boyd	0.25 M	3	0	1	0	0	0
	0.5 M	11	0	2	0	3	0
12th SE St/Cobblestone	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	1	0
24th Ace NE/Robinson	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
24th st/E Lindsay	0.25 M	0	0	0	0	1	0
	0.5 M	0	0	0	0	1	0
24th W/Terrace	0.25 M	2	0	0	0	0	0
	0.5 M	6	2	0	1	1	0
36th St/East Robinson	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
36th St/Summit Crossing Parkway	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	1	0
36th St/Brookhollow	0.25 M	1	0	0	0	1	0
	0.5 M	6	0	1	1	2	0
36th St/Cascade	0.25 M	2	0	1	1	0	0
	0.5 M	3	0	5	1	2	0
36th St/Main	0.25 M	2	1	1	1	0	0
	0.5 M	6	1	1	1	0	0
36th NE/Rock Creek	0.25 M	0	0	0	0	0	0

	0.5 M	0	0	0	0	0	0
36th NW/Rock Creek	0.25 M	1	0	0	0	0	0
	0.5 M	1	0	1	1	3	0
48th St/main	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	1	0
48th St/Robinson	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
60th St/Alameda	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
60th St/Lindsey	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
72nd SE/highway 9	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
Acres/Jones	0.25 M	2	0	0	0	2	0
	0.5 M	8	0	4	4	3	0
Alameda/Sherwood	0.25 M	0	0	0	1	1	0
	0.5 M	5	1	4	2	3	0
Alameda/Shiloh	0.25 M	2	0	0	0	1	0
	0.5 M	12	1	3	1	2	1
Alameda/Morningside	0.25 M	0	0	1	0	1	0
	0.5 M	3	0	2	2	4	1
Alameda/24th NE	0.25 M	0	0	0	0	0	1
	0.5 M	3	0	0	0	0	1
Apache/Carter	0.25 M	0	0	1	0	1	0
	0.5 M	5	0	2	2	3	1
Barkley St/Harley	0.25 M	3	0	0	0	0	0
	0.5 M	9	0	1	1	3	0
Berry/Boyd	0.25 M	0	0	0	0	0	0
	0.5 M	1	0	0	0	2	0
Berry/Lindsey	0.25 M	3	0	0	0	0	0
	0.5 M	6	1	0	1	0	0
Berry Rd/Inhoff	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	1	0
Boyd/McGee	0.25 M	0	0	0	0	1	0
	0.5 M	5	1	1	1	1	1
Boyd/24th Ave SW	0.25 M	2	0	0	0	0	0
	0.5 M	8	1	0	1	0	1
Boyd/Barkley St	0.25 M	2	0	0	0	0	0
	0.5 M	6	0	1	0	4	0

Boyd/Flood	0.25 M	0	0	0	0	1	0
	0.5 M	0	0	0	0	2	0
Boyd/Lahoma	0.25 M	0	0	0	0	1	0
	0.5 M	0	0	0	0	2	0
Boyd/Shiloh	0.25 M	3	0	0	0	1	0
	0.5 M	10	0	1	0	3	1
Boyd/Sunrise	0.25 M	3	0	0	0	1	0
	0.5 M	12	0	2	0	3	0
Boyd/Wylie	0.25 M	0	0	0	0	1	0
	0.5 M	2	0	0	0	1	0
Brookhaven Blvd./Charing Cross Court	0.25 M	0	0	0	0	1	0
	0.5 M	1	0	0	0	2	0
Brooks/McGee	0.25 M	3	0	1	1	0	1
	0.5 M	8	1	1	2	1	1
Brooks/24th W	0.25 M	3	0	0	0	0	0
	0.5 M	9	0	0	1	0	0
Brooks/12th St	0.25 M	3	0	0	0	0	0
	0.5 M	13	0	1	1	3	0
Caddell/Berry	0.25 M	0	0	0	0	0	0
	0.5 M	5	0	0	0	2	0
Castlerock Road/Tecumseh	0.25 M	0	0	0	0	1	0
	0.5 M	1	0	1	1	2	0
Central parkway/Pelham Dr.	0.25 M	0	0	0	0	1	0
	0.5 M	0	0	0	0	4	1
Charlotte Ct/Sunrise	0.25 M	1	0	0	0	1	0
	0.5 M	11	0	1	0	3	0
Classen/Alameda	0.25 M	1	0	1	1	1	1
	0.5 M	9	0	1	1	5	1
Classen/highway9	0.25 M	0	1	0	0	0	0
	0.5 M	0	1	2	0	1	0
Classen/Boyd	0.25 M	0	0	0	0	2	0
	0.5 M	11	0	0	0	3	0
Collier/Main	0.25 M	2	1	0	1	0	0
	0.5 M	3	2	0	1	0	0
Comanche/Chautauqua	0.25 M	2	1	0	1	1	0
	0.5 M	12	1	1	1	3	0
Crestland Dr./Morren Dr.	0.25 M	0	0	0	0	1	0
	0.5 M	4	1	1	1	1	1
Daws/Porter	0.25 M	4	0	0	2	1	0

	0.5 M	10	0	6	5	5	1
Devonshire Dr./Lochwood Dr.	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	1	0
Highland Pkwy/Dorchester Dr.	0.25 M	2	0	0	0	1	0
	0.5 M	6	0	0	1	1	0
E 36th St/Lindsey	0.25 M	1	0	0	0	0	0
	0.5 M	4	0	0	0	0	0
E Highway 9/108th St	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
E. Brooks St./Oklahoma Ave.	0.25 M	1	0	0	0	1	0
	0.5 M	9	0	0	0	3	0
Eagle Cliff/Goshawk	0.25 M	0	0	0	0	1	0
	0.5 M	0	1	0	0	1	0
Elmhurst Ave/Oakcrest Ave	0.25 M	0	0	0	0	0	0
	0.5 M	1	0	0	0	2	0
Finch/heron	0.25 M	0	0	0	1	1	0
	0.5 M	2	0	3	0	2	0
Flood/Robinson	0.25 M	0	0	0	0	0	0
	0.5 M	5	0	0	1	2	0
Flood/main	0.25 M	4	1	0	1	0	0
	0.5 M	10	1	1	1	3	0
Harrogate/Hawkesbury Park	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	1	0
Hey 9/60th SE	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
Hey 9/Berry	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
High Meadows/Wind Hill Rd.	0.25 M	0	0	0	0	1	1
	0.5 M	0	0	0	0	2	1
Hollywood/Vine	0.25 M	0	1	0	0	1	0
	0.5 M	6	1	1	2	1	0
Huron St/Erie Ave	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	2	1
Hwy 9/Chautauqua	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	2	0
I35/Main St	0.25 M	1	0	0	0	1	0
	0.5 M	8	2	0	2	1	0
Imhoff/Chautauqua	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	1	0

Imhoff/Oakhurst	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	1	0	1	0
Indian Hills Rd/36th Ave	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
Iowa/Merkle	0.25 M	0	0	0	0	0	0
	0.5 M	1	1	1	1	1	0
Iowa/Thorton	0.25 M	0	0	0	0	0	0
	0.5 M	2	1	0	0	1	0
Jackson/Crest Place	0.25 M	0	0	0	0	1	0
	0.5 M	6	2	2	2	2	0
Jenkins/Linn	0.25 M	6	0	0	1	1	1
	0.5 M	14	0	2	1	3	1
Jones/Johnson	0.25 M	2	0	1	0	0	0
	0.5 M	6	0	6	6	3	0
Lakewood/Meadowbrook	0.25 M	0	0	0	0	1	0
	0.5 M	0	0	0	0	1	0
Lindsay/sooner	0.25 M	1	0	0	0	0	0
	0.5 M	8	0	0	0	1	0
Lindsey/highway9	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
Lindsey/Oakhurst	0.25 M	1	0	0	0	0	0
	0.5 M	6	0	0	0	4	0
Linn/Santa Fe	0.25 M	6	0	0	0	0	0
	0.5 M	16	0	1	1	3	0
Main/Berry	0.25 M	2	0	0	0	0	0
	0.5 M	4	1	0	1	1	0
Main/NW 24th St	0.25 M	2	1	0	1	0	0
	0.5 M	3	3	0	2	1	0
Main/Porter	0.25 M	3	0	0	1	0	0
	0.5 M	10	0	3	3	5	1
Main St/Cherry Creek Dr.	0.25 M	0	1	1	0	0	0
	0.5 M	2	1	1	1	1	0
McGee/Lindsey	0.25 M	4	1	1	2	0	1
	0.5 M	6	1	1	2	1	1
McGee/Highway9	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	1	2	0
Mockingbird/Morningside	0.25 M	3	0	1	0	0	0
	0.5 M	9	1	2	2	3	0
N. W. 12th/Tecumseh Rd.	0.25 M	0	0	0	0	0	0

	0.5 M	0	0	0	0	0	0
NE 24th/Cottonwood	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	2	0
Night Hawk Dr./Eagle Cliff	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	1	0
Oak Tree Ave/12th Ave SE	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	2	0	1	0
Oakhurst/Lakehurst	0.25 M	0	0	0	0	1	0
	0.5 M	1	0	0	0	2	0
Oklahoma/Tulsa	0.25 M	1	0	0	0	2	0
	0.5 M	8	0	0	0	3	0
Peters/Tonhawa	0.25 M	3	0	1	1	2	0
	0.5 M	13	0	3	4	5	1
Peters/Alameda	0.25 M	2	0	0	1	2	1
	0.5 M	15	0	2	2	4	1
Peters/Robinson	0.25 M	1	0	2	0	1	0
	0.5 M	6	0	5	4	0	0
Pichard/Lindsey	0.25 M	4	0	0	0	0	0
	0.5 M	5	0	0	0	0	0
Pickard Ave/Symmes	0.25 M	0	0	0	0	1	0
	0.5 M	4	1	0	1	2	0
Pickard/Brooks	0.25 M	1	0	0	0	0	0
	0.5 M	4	0	0	0	1	0
Pine tree/cherry creek	0.25 M	0	0	0	0	0	0
	0.5 M	2	1	1	1	1	0
Porter/Highland Village Dr.	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	3	0
Porter/Robinson	0.25 M	2	0	5	3	0	0
	0.5 M	5	0	6	4	2	0
Porter/Rock Creek (7)	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	1	0
Porter/Tecumseh	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
Rhoades Drive/Rhoades Court	0.25 M	0	0	0	0	1	0
	0.5 M	0	0	0	0	1	0
Rhodes/Baker	0.25 M	0	0	0	0	1	0
	0.5 M	0	0	0	0	1	0
River Oaks Drive/Main	0.25 M	2	1	1	0	0	0
	0.5 M	6	1	1	1	0	0

Robinson/Woods	0.25 M	1	0	0	0	0	0
	0.5 M	5	0	0	0	1	0
Robinson/24th Ave	0.25 M	1	0	3	2	0	0
	0.5 M	4	1	6	5	1	0
Robinson/36th Ave NW	0.25 M	2	0	1	1	0	0
	0.5 M	3	0	1	1	2	0
Robinson/Brookdale	0.25 M	0	0	0	0	0	0
	0.5 M	2	0	1	1	0	0
Robinson/Rambling Oaks Dr	0.25 M	1	0	0	0	0	0
	0.5 M	4	1	1	3	2	0
Robinson/Berry	0.25 M	2	0	0	0	0	0
	0.5 M	6	0	0	0	1	0
Rock creek/Sequoia trail	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	1	0
Rock Creek/Trailwood Dr.	0.25 M	2	0	0	1	0	0
	0.5 M	5	0	0	1	1	0
Rock Creek Rd/12th Ave	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	3	0
SE 24th Ave/Rte. 9	0.25 M	0	0	1	0	0	0
	0.5 M	0	0	1	1	1	0
SE 72nd/Hwy 9	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
Sherry/Westchester	0.25 M	1	1	0	0	0	0
	0.5 M	2	1	0	0	0	0
Shrill/Goldfinch Ct	0.25 M	0	0	0	0	1	0
	0.5 M	2	0	3	1	2	0
Sooner Dr/Garfield	0.25 M	0	0	0	0	0	0
	0.5 M	5	1	0	0	0	0
Sunset/Gatewood	0.25 M	2	0	0	0	0	0
	0.5 M	5	0	0	1	2	0
Symmes/Lahoma	0.25 M	0	0	0	0	1	0
	0.5 M	12	1	0	1	2	0
Symmes/Porter	0.25 M	2	0	1	1	1	1
	0.5 M	11	0	3	2	3	1
Tecumseh/36th NW	0.25 M	2	0	2	1	0	0
	0.5 M	3	0	5	1	1	0
Tecumseh Rd/24th Ave NE	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
Terrace pl/Brentwood	0.25 M	2	0	0	0	0	0

	0.5 M	6	2	0	1	1	0
Tonhawa/Lahoma	0.25 M	3	1	0	1	0	0
	0.5 M	12	1	1	2	4	0
University/Comanche	0.25 M	9	1	1	0	1	0
	0.5 M	15	1	1	1	5	1
Vicksburg/Alameda	0.25 M	3	0	0	0	0	0
	0.5 M	5	0	0	0	1	1
Walnut/Robinhood Ln	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	2	0
Walnut/Imhoff	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	1	0
Walnut/Meadowbrook	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	0	0
Wauwinet/Quidnet Rd.	0.25 M	0	0	0	0	0	0
	0.5 M	0	0	0	0	1	0
West Eufaula St/Park Dr.	0.25 M	8	1	0	0	1	0
	0.5 M	14	1	1	1	3	0
Wichita Dr/Sequoyah Trail	0.25 M	0	0	0	0	1	0
	0.5 M	0	0	0	0	1	0
Woodcrest Dr/Woodcrest Cr.	0.25 M	0	0	0	0	1	0
	0.5 M	0	0	0	0	2	0
Wylie/Lindsey	0.25 M	2	1	0	1	0	0
	0.5 M	7	1	1	2	1	1
Wylie Rd./Ann Arbor Dr.	0.25 M	0	0	0	0	0	0
	0.5 M	3	1	0	0	1	0

Table 15: Number of services within the .25-mile and .5-mile distances, across the sample of intersections.

Appendix B. Survey

Online Consent to Participate in Research
This research has been approved by the University of Oklahoma, Norman Campus IRB.
IRB Number: 11876 **Approval date: Jan 13, 2023**

Would you like to be involved in research at the University of Oklahoma?

I am Sara Fast from the College of Architecture and I invite you to participate in my research project entitled Aging in Place: A Study of Preferred Neighborhood Attributes Among Middle-Aged and Senior citizens. This research is being conducted in Oklahoma. You were selected as a possible participant because you are age 50 or over. You must be at least 18 years of age to participate in this study.

Please read this document and contact me to ask any questions that you may have BEFORE agreeing to take part in my research.

What is the purpose of this research? The purpose of this research is to enable urban designers and planners identify attributes and features that middle age and older individuals prefer in their neighborhoods. The result of this study will help professionals to be able to address these desires and preferences in the design process of built environment.

How many participants will be in this research? About 10000 participants- 5000 individuals age 50-65 and 5000 individuals age 65 or over will take part in this research.

What will I be asked to do? If you agree to be in this research, you will fill out a survey with 25 questions.

How long will this take? Your participation will take 10- 15 minutes.

What are the risks and/or benefits if I participate? There are no risks and no benefits from being in this research. There are no risks and no benefits from being in this research.

Will I be compensated for participating? You will not be reimbursed for your time and participation in this research.

Who will see my information? In research reports, there will be no information that will make it possible to identify you. Research records will be stored securely, and only approved researchers and the OU Institutional Review Board will have access to the records.

Data are collected via an online survey system that has its own privacy and security policies for keeping your information confidential. Please note no assurance can be made as to the use of the data you provide for purposes other than this research.

What will happen to my data in the future?

After removing all identifiers, we might share your data with other researchers or use it in future research without obtaining additional consent from you.

Do I have to participate? No. If you do not participate, you will not be penalized or lose benefits or services unrelated to the research. If you decide to participate, you don't have to answer any question and can stop participating at any time.

Who do I contact with questions, concerns or complaints? If you have questions, concerns or complaints about the research or have experienced a research-related injury, contact me at 405-339-****, or email Sara.Fast-1@ou.edu or Dr. Charles Warnken at 405-325-**** or email cwarnken@ou.edu.

You can also contact the University of Oklahoma – Norman Campus Institutional Review Board (OU-NC IRB) at 405-325-8110 or irb@ou.edu if you have questions about your rights as a research participant, concerns, or complaints about the research and wish to talk to someone other than the researcher(s) or if you cannot reach the researcher(s).

Please print this document for your records. By providing information to the researcher(s), I agree to participate in this research.

- o I agree
- o I disagree

Respondent Characteristics

1. **How old are you?**

   50-65

   68-80

   Over 80 years old

The next sets of questions (number 2 to 6) relate to different preferred neighborhood features and services. As you think about life in an "**ideal neighborhood"**, consider how important it is to you to have each of them.

Physical Environment

2. **When you think about a place to live how important is it to you to have the following features in the neighborhood?**

	Extremely important	Somewhat important	Not very important	Not at all important
a) Well maintained streets	○	○	○	○
b) Low Density	○	○	○	○
c) Enough benches for resting in public areas like parks, along sidewalks, and around public buildings	○	○	○	○
d) The general appearance of buildings in the neighborhood and clean neighborhood	○	○	○	○
e) Parks and green spaces	○	○	○	○
f) Public buildings and spaces including restrooms that are accessible to people of different physical abilities	○	○	○	○

Transportation

3. When you think about a place to live how important is it to you to have the following features in the neighborhood?

	Extremely important	Somewhat important	Not very important	Not at all important
a) Bus routes	○	○	○	○
b) Bicycle facilities	○	○	○	○
c) Public transportation	○	○	○	○
d) Close to major roads	○	○	○	○
e) Special transportation options for the elderly and people with disability	○	○	○	○
f) Conveniently located public parking lots including parking for people with disabilities	○	○	○	○

Access to Amenities

4. When you think about a place to live how important is it to you to have the following features in the neighborhood?

	Extremely important	Somewhat important	Not very important	Not at all important
a. High-quality public schools	○	○	○	○
b. Homes of friends and relatives within walking distance	○	○	○	○
c. Recreation facilities within walking distance	○	○	○	○
d. Grocery stores within walking distance	○	○	○	○
e. Cultural offerings and activities within walking distance	○	○	○	○
f. Religious centers (e.g. Church, mosque, synagogue, …)	○	○	○	○
g. Access to downtown/city center within 20-minute driving distance	○	○	○	○
h. Access to the workplace within 10-minute driving distance	○	○	○	○
i. Doctor, pharmacy, and emergency care centers within walking distance	○	○	○	○
j. Access to places where older people can go for advice and support (e.g. senior center)	○	○	○	○
k. Access to social clubs such as book, gardening, craft or hobby within walking distance	○	○	○	○
l. Affordable delivery system	○	○	○	○

Well-being, Safety, and Security

5. When you think about a place to live how important is it to you to have the following features in the neighborhood?

	Extremely important	Somewhat important	Not very important	Not at all important
a) Low noise level and Calm	○	○	○	○
b) Clean air	○	○	○	○
c) Little crime	○	○	○	○
d) Reduced (e.g. 15-25 mph) speed limits for cars	○	○	○	○
e) Low traffic intensity	○	○	○	○
f) Safe public transportation stops or areas that are accessible to people of varying physical abilities	○	○	○	○
g) Sidewalks that are in good condition and accessible for wheelchairs or other assistive mobility devices	○	○	○	○
h) Safe crossings that have both audio and visual signals	○	○	○	○
i) Separate pathways for bicyclists and pedestrians	○	○	○	○
j) Having an emergency shelter within walking distance (For tornado, flood, …)	○	○	○	○

Community Values

6. When you think about a place to live how important are the following factors to you?

	Extremely important	Somewhat important	Not very important	Not at all important
a. High Social status (1)	○	○	○	○
b. Having the opportunity to participate in decision making bodies such as community councils or committees (2)	○	○	○	○
c. Nice neighbors (3)	○	○	○	○
d. Racial/Ethnic diversity of the neighborhood (4)	○	○	○	○
e. No majority of immigrants in the neighborhood (5)	○	○	○	○
f. Majority of people from the same race/ethnicity as you in the neighborhood (6)	○	○	○	○
g. A neighborhood where people know each other (7)	○	○	○	○
h. A feeling of belonging to the neighborhood (8)	○	○	○	○
i. A neighborhood where people have respect for older people (9)	○	○	○	○
j. A neighborhood where people are willing to help each other whenever necessary (10)	○	○	○	○
k. Shared religious beliefs (11)	○	○	○	○

The next set of short questions is designed to help us analyze the survey results. All your answers in this survey are anonymous, which means there is no information that will make it possible to identify you.

7. **You identify your gender as?**

   Man

   Women

   Other

   Prefer not to disclose

8. **What do you identify your race/ethnicity as?**

   Black or African American

   Hispanic or Latino

   Asian

   White or Caucasian

   American Indian or Alaska Native

   Other

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

   K-12th grade (no diploma)

   High school graduate, GED or equivalent

   College degree

   Graduate or professional degree(s)

10. **What is your current marital status?**

    Married, living with partner or family

    Separated or Divorced

    Widowed

    Never married

11. Do you have any of the following people living in your household?

Child/children under 18

Child/children 18 or older

Parents

Other relative or friend under 18

12. Which of the following best describes your current employment status?

Self-employed

Employed

Unemployed, but looking for work

Retired, not working at all

Not in labor force for other reasons

13. What was your annual household income before taxes in the most recent tax year?

Less than $40,000

$40,000 to $60,000

$60,000 to $80,000

$80,000 to $100,000

$100,000 and more

14. Do you and/or your spouse have any disability, handicap, or chronic disease?

Yes, myself

Yes, my spouse or partner

Yes, both me and my spouse or partner

No

15. How long have you lived in this neighborhood?

Less than 5 years

5-15 years

16-25 years

26-35 years

36-45 years

More than 45 years

16. What is the nearest intersection to your home?

17. How would you rate your neighborhood as a place for people to live as they age?

Excellent

Very good

Good

Fair

Poor

18. How likely or unlikely are you to recommend living in your neighborhood to older adults?

Very likely

Likely

Unlikely

Very unlikely

19. How important is it to you to be able to remain in your home as you age?

Very important

Somewhat important

Not important

20. How important is it to you to be able to remain in your neighborhood as you age?

Very important

Somewhat important

Not important

21. Do you currently own or rent your home?

Rent

Own (with a mortgage payment)

Own (free and clear; no mortgage)

Live with somebody else

22. About how much is your monthly housing cost for the place you live (including rent, mortgage payment, property tax, property insurance and homeowners' association (HOA) fees)?

Less than $300 per month

$300 to $599 per month

$600 to $999 per month

$1,000 to $1,499 per month

$1,500 or more

23. What is your usual way of travelling to appointments, errands, events or other locations? If more than one, select the one which takes the most time.

I drive myself

I am driven by friends or family

I use a taxi or car service company (Foe example: Uber, Lyft, …)

I take a public bus

I walk

I use senior transportation service or a service for individuals with disability

Other

We have just two more questions that will help us evaluate your current neighborhood. The survey is almost complete. Thank you for your continued participation.

24. what you like the most about your current neighborhood?

25. What would you like to change about your current neighborhood?

Appendix C. Recruitment Material

Aging in Place: A study of Preferred Neighborhood Attributes Among Middle-aged and Older Adults

Recruiting

Adults age 50 0r more, for a research study that is exploring aging in place.

Participation involves:

Filling out an online survey that takes 10-15 minutes.

Your participation is completely voluntary and there are no costs to you for participating in this study.