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HEALTH IMPACTS OF PARKS AND TRAIL SYSTEMS, LESSONS LEARNED FROM THE OVERTON PARK SYSTEM FORT WORTH, TEXAS

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by

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Abstract

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FORT WORTH, TEXAS

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This thesis explores the health impacts of parks and trail systems on residents by studying the Overton Park System in Fort Worth, Texas. Specifically, this research assesses how park features, amenities, and experiences impact physical activity levels of residents who live nearby. The Overton Park System, as defined in this study, consists of Overton Park, Foster Park, and the trail system that connects them to the Trinity Trail System.

Numerous studies have shown the health benefits of daily physical activity over a sedentary lifestyle (Lewis and Hennekens, 2016). Literature illustrates that parks and trail systems offer an array of amenities and features that encourage physical activity while simultaneously enjoying the outdoors (Gordon et al., 2004). However, the research that explores the impact that parks and trail systems have on physical activity is limited.

This study adopts quantitative research methods as described by (Demming and Swafield, 2011), and collects data through a survey of residents, passive observations, as well as a review of secondary data to assess physical activity levels of residents. A three-part survey focuses on physical activity of residents in four adjacent neighborhoods near the Overton Park System in Fort Worth, Texas. Passive observations and secondary data collection focus on physical attributes and demographic profiles of the park and the neighborhood under question (Lynch and Hack, 1984). Data are analyzed using descriptive statistics and frequencies to report on the impacts that park features, amenities, proximity, accessibility and perception have on resident's physical activity levels.

This research explores the health impacts parks and trail systems contribute to residents of surrounding neighborhoods and communities. Existing research is used to compare against the data collected in order to find evidence and examples that show people with easy access to parks and trail systems have higher physical activity levels than people who do not have those resources readily accessible (Gordon et al., 2004). The limits of value based on proximity and ease of access to trail systems are explored and established through analysis of data collected through the survey and existing research. Overall, the results generally supported existing literature in that close proximity and ease of access to parks and trail systems is resultant in increased physical activity levels for surrounding residents.

The findings from this study and related studies help reinforce the importance of the profession of landscape architecture and its role in enhancing, respecting, and restoring the life sustaining integrity of the landscape for all living things. Ease of access to parks and trail systems for physical activity should be viewed as having a positive health value, and communities should construct their policies and resources accordingly. Increased public knowledge of the health benefits associated with daily physical activity as related to living in close proximity to parks and trail systems is a benefit to any community.

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Chapter 1 Introduction

1.1 Background

Health has been an used as an argument and justification for urban parks and trail systems in the United States dating back to the mid nineteenth century, well before the health value of physical activity was broadly recognized. The United States medical community of the time, taking their lead from peers in the United Kingdom, believed that the filth and uncleanliness of fast growing industrial cities created miasmas, defined as noxious gases, which were a source of most all disease (Crompton, 2013). Urban Parks were perceived to provide protection from these gases due to plants producing oxygen. Governmental entities believed parks reduced societal costs associated with poverty and lost labor productivity, while individuals viewed parks as offering a defense against contagious diseases (Crompton, 2013).

Within the last twenty years, advocates for urban parks have begun to argue that urban parks help promote physical activity. The relationship between physical activity and health has been reinforced through numerous studies and is now more broadly accepted (Warburton et al., 2006). Parks and trail systems provide opportunities for physical activity in outdoor environments that have advantages. This contemporary health justification is reminiscent of arguments that were used with great effect in the middle of the nineteenth century to justify

the use of public funds for urban parks. Frederick Law Olmsted, who is considered the father of landscape architecture, referred to urban parks as "the lungs of the city" and spoke of "the two great natural agents of disinfection, sunshine and foliage" when explaining how parks and tree lined boulevards performed their cleansing role (Crompton, 2013). The theories and argument of the mid nineteenth century hold true today and have been scientifically proven (Nowak and Heisler, 2010). Building on the analogy of the mid nineteenth century as parks representing the "lungs of the city", the modern argument that parks and trail systems provide a community resource that accommodates and promotes physical activity while contributing to the health of residents, trail systems can be looked at as representing the circulatory system of the city. The human body's circulatory system moves blood through the lungs to get rid of waste and replenish oxygen needed for healthy bodily functions, trail systems move residents through parks and green space helping to contribute to a healthier lifestyle.

1.2 Purpose of Study

This research explores the health impacts that parks and trail systems have on residents by studying the Overton Park System in Fort Worth, Texas. Specifically, this research assesses how park features, amenities, and experiences

impact physical activity levels of residents in surrounding neighborhoods and communities. This research also focuses on the overall physical activity levels of residents as well as their proximity and ease of access to the park system in order to better understand these aforementioned impacts. By doing so, this research addresses the health impacts of landscape architecture and future design implications.

1.3 Research Questions

The research questions explored within the confines of the Overton Park System in Fort Worth, Texas are:

1. What are the physical activity levels of residents who live near the Overton Park System?
2. To what extent do park features and amenities impact physical activity of residents near the Overton Park System?
3. To what extent does proximity, connectivity and accessibility impact the physical activity of residents near the Overton Park System?
4. To what extent do perceptions of the park space and park experience impact physical activity of residents near the Overton Park System?

1.4 Definition of Key Terms

This section defines key terms that are focused on throughout this research study.

The Overton Park System: as defined in this study, consists of Overton Park, Foster Park, and the trail system that connects them to the Trinity Trail System and the Trinity River.

Park: A long standing definition of the word park comes from a quote by Charles Doell "a piece of land or water set aside for the recreation of the people" (Molinar and Rutledge, 1986)

Meriam Webster defines park as:

- a piece of public land in or near a city that is kept free of houses and other buildings and can be used for pleasure and exercise
- a large area of public land kept in its natural state to protect plants and animals

The definition of "park" that is focused on throughout this research will be defined as a piece of ground kept for ornament, preservation and recreation of the people.

Trail System: There is no legal definition of a trail system, and the only relevant definition of "trail" is: a route that someone follows to go somewhere or achieve something (Meriam Webster, 2016).

The definition of trail system for the purpose of this research will be: A series of interconnected mixed use pathways for pedestrian and bicycle use that accommodates movement through parks and greenways.

Health: The World Health Organization defines health as "not merely the absence of disease," but "a state of complete physical, mental and social well-being" (World Health Organization, 1948).

Physical Activity: is defined by the World Health Organization (2015) as any bodily movement produced by skeletal muscles that requires energy expenditure. Physical activity includes sports, exercise and other activities such as playing, walking, doing household chores, gardening, and dancing (World Health Organization, 2015). Physical activity is categorized based on either type or intensity level.

1.5 Research Methods

The research questions are addressed through quantitative methods (Demming and Swafield, 2011) in order to evaluate the health value of parks and trail systems in the Overton Park System in Fort Worth Texas. Data collection

occurs through a three-part, twenty two question survey as well as passive observation and secondary data. The survey, created by the researcher using modified questions based on the studies research questions, was used to collect data from the study population using Likert scale questions, multiple answer questions, and short answer questions. The survey was sent electronically to resident members of the neighborhoods bordering the Overton Park System. The results of the survey were analyzed using descriptive statistics and frequencies.

1.6 Significance and Limitations

This research explores the health impacts that parks and trail systems have on residents by studying the Overton Park System in Fort Worth, Texas focusing on the overall physical activity levels of residents as well as their proximity and ease of access to the park system in order to better understand these impacts. This research also assesses how park features, amenities, and experiences impact physical activity levels of residents in surrounding neighborhoods and communities. Lessons learned from this research can be used to help guide future development and provide landscape architects and city planners validation when proposing parks and trails systems. Providing parks and trail systems can contribute to the overall health of neighborhoods and communities.

One of the limitations to this research is that the survey was developed by the researcher for the purposes of this study alone and is not a validated measurement tool. The study not being randomized and only focusing on one location can also be considered limitations. Countless factors contribute to health, but this study primarily uses physical activity to assess health, which could be considered a limitation. Incorporation of additional factors to health was beyond the scope of this study. Researcher may have previous bias based on background that could impact this study and may also be viewed as a limitation.

1.7 Study Overview

This research assesses how park features, amenities, and experiences impact physical activity levels of residents who live near the Overton Park System. Numerous studies have shown the health benefits of daily physical activity over a sedentary lifestyle (Lewis and Hennekens, 2016; US Department of Health and Human Services, 1996). The literature review illustrates that parks and trail systems offer an array of amenities and features that encourage physical activity while simultaneously enjoying the outdoors. However, the research that explores the impact that parks and trail systems have on physical activity is limited.

This study adopts quantitative research methods as described by Demming and Swaffield (2011) and collects data through a survey of residents, passive observations, as well as a review of secondary data to assess physical activity levels of residents. A three-part survey focuses on physical activity of residents in four adjacent neighborhoods near the Overton Park System in Fort Worth, Texas. Data is analyzed using descriptive statistics and frequencies to report on the impacts that park features, amenities, proximity, accessibility and perception have on resident's physical activity levels. The research methods used in this studied are detailed in Chapter three.

This research is designed to explore the health value parks and trail systems contribute to residents of neighborhoods and communities. The limits of value based on proximity and ease of access to trail systems is explored and established through analysis of data collected through the survey and existing research. Chapter four details the process of analyzing the data and illustrates the data and findings of the survey. Results of data analysis are compared against data of similar studies to strengthen the argument that parks and trail systems offer a health value to neighborhoods, communities and cities as a whole. Chapter five concludes the thesis by: Revisiting the research questions; Discussing the implications for design and planning; Discussing the studies relevance to landscape architecture and future research opportunities.

Chapter 2 Literature Review

2.1 Introduction

Promoting physical activity among children and adults has become a priority national health objective in the United States (Activelivingresearch.org, (2016). Regular physical activity lowers the risk of chronic diseases and is an important strategy for reversing the obesity epidemic (Activelivingresearch.org, (2016). Despite this evidence, however, the vast majority of adults in the United States remain effectively sedentary; less than one-third of Americans meets the minimal recommendations for physical activity as outlined by expert panels at the Centers for Disease Control and Prevention (CDC), American College of Sports Medicine (ACSM), and American Heart Association (AHA) (Myers, 2003). Finding ways to make physical activity more accessible and easily incorporated into the daily life of the community should become a priority for city planners, designers, and developers when considering developments and communities of the future.

Parks and trail systems provide an opportunity to engage in physical activity and increase a person's daily activity. Trails encourage an active lifestyle by accommodating and encouraging a variety of physical activities while enjoying the outdoors. Trails can help create a new way of life for the people in a community by accommodating interaction with the outdoor environment while

engaging in physical activity. Recreational trails make it easier for people to engage in an active lifestyle that has been shown to provide many health benefits (ACSM Health and Fitness, 2012).

Trails are designated, marked and signed routes that people use recreationally or as a physically active way of traveling. Activities that are possible as a result of linear parks and trail systems include: walking, running, bicycling, wheelchair exercise, roller-skating, skateboarding, cross-country skiing, and snowshoeing. The recreational experience offered by parks and trail systems is not only determined by the type of activity, but also by the setting where the activity takes place. Physical attributes that can define the setting include: topography, vegetation, social factors, neighborhood character, and manicured or natural landscapes (ACSM Health & Fitness, 2012). Figure 2-1 provides a quick overview and illustrates the main purposes of some of the primary sources of reviewed literature.

Cohen et al. 2007	McKenzie and Van Der Mars 2015	Kaczynski 2008	Kaczynski 2014	Abildso 2007	Bedimo-Rung 2005	Henderson 2007
Contribution of Parks to Physical Activity	Assessing Physical Activity and its Contexts	Association of Park Size, Distance, and Features with Physical Activity	Are Park Proximity and Features Related to Park-Based Physical Activity Among Adults? Variations by Multiple Socio-Demographic Characteristics.	Built Environment and Psychosocial Factors Associated With Trail Proximity and Use	The significance of Parks to Physical Activty and Public Health	Urban Parks and Trails and Physical Activity
Study of 8 Parks in low income/minority Neighborhoods	Uses Systematic Observation	Collected data in 4 neighborhoods in Ontario, Canada	Randomly selected households (n=893) in Kansas City, Missouri in 2010-2011	Perceved vs objective proximity in relation to use of newly constructed trail in Morgantown, West Virgina	Proposes a Conceptual Model to guide thinking about relationships between park benefits, park use and physical activity	Provide a summary of the research that describes the relationships between parks, trails and greenway, and opportunities for healthy living through physical activity
Scope: Size, Accesibility, availability/ proximity, and quality of amenities	Section 1 Methodological Questions Which observation tactics should be used?	Scope: Park Size, Distance, and	Scope: Proximity, availability, gender, age, race, and imcome while controlling for all socio-demographic characteristics and BMI	Scope: GIS Mapping, Psychosocial Barriers to Physical Activity, Percieved Neighborhood Walkability, Distance Perception Catagories	Park environmental characteristics that could be related to physical activity.	Scope: Physical activity in urban parks and trails Proximity, Park and trail characteristics
Methods: Observation and Interviews	Methods: Systematic Observation	Methods: Distrubuted study packages including 7 physical activity logs and abreviated Neighborhood Environment Walkability Survey (NEWS). Distance studied using GIS Euclidean distance. Characteristics studied using Enironmental Assessment for Public Recreation Spaces (EAPRS) instrument	Mail Survey sent to randomly selected Residents	Methods: Telephone interviews during an eight week period		References many studies with various findings on the relationship between parks and physical activity.
Findings: Proximity 43% lived .25 mi, 21% .25-.5 mi only 13% lived > 1 mi Age: younger +; Gender - male +; Distance within 1 mi = 4x's more likely to use park and reported 38% more exercise per week		Analysis: Binary logistic regression used to examine differences between parks with physical activity and those with no physical activity	Analysis: Multilvel logistic regression to examine the relationship between park use and park based PA and three measures of park proximit and availability within 1 mile of participants. Separate analyses were conducted by gender, age, race, and imcome while controlling for all socio-demographic characteristics and BMI	Responses were coded and ransfered to SPSS for Windows statistical software package for analysis. Chi-square analysis was used	Characteristics include: park features, condition, access, asthetics, safety, and policies	MORE RESEARCH IS NEEDED before Policy Makers can use as evidence.
Primary finding: Residential proximity to a park was the most robust predictor of both park use and self reported exercise		Primary Findings: The presence of paved trails, unpaved trails, and wooded areas were significantly related to park based physical activity. Park ^{s} with Paved Trails were 26 times more likely to be used for Physical Activity	Primary Findings: Distance to the closest park was not significantly related to eother park use or park-based PA. Significant associations were found for the relationship of number of parks and amount of park space within 1 mile for both out comes.	Primary Findings: Significant relationship among distance-perception and trail use. Both catagories that percived being close to the trail reported more trail use.		Limitations are noted and rationale is made for conducting further research to more clearly shows the links between urban parks, trails and physical activity.

Figure 2-1 Literature Review Matrix

2.2 Parks and Trail Systems

2.2.1 History

The definition of "parks" that is focused on throughout this research is: A piece of ground kept for ornament, preservation, environmental function and recreation. A growing body of evidence shows that the built environment can positively influence physical activity for both recreational and transportation purposes. Broadly defined, the built environment includes the man-made surroundings that provide settings for physical activity, such as neighborhoods, streets, public transportation systems, commercial centers, schools, parks, trails and other outdoor recreational spaces (Lee and Moudon, 2004; Activelivingresearch.org, 2016).

The built environment in this research includes the Overton Park System and four surrounding neighborhoods including: Tanglewood, Overton Park, Foster Park, and Westcliff West. Trail systems consist of multi-use trails or marked pathways. A multi-use trail allows for two-way, off-street pedestrian and bicycle use. Wheelchairs, joggers, skaters and other non-motorized users are also welcome on multi-use trails. These trails are frequently found in parks, along rivers, beaches and in greenbelts or utility corridors where there are few conflicts with motorized vehicles. Trail systems usually connect parks or neighborhoods with other parks, neighborhoods, or areas of interest within a community.

Urban parks can be categorized as neighborhood parks, community parks, pocket parks, or linear parks. Neighborhood parks are usually located within walking or bicycling distance of most users, these parks are generally three to five acres in size and primarily serve residents within a half-mile radius. Neighborhood parks are designed primarily for providing access to basic recreation opportunities for nearby residents, enhancing neighborhood identity, and preserving neighborhood open space (Molinar and Rutledge, 1986). Community parks are usually twenty to one hundred acres in size and are designed to be used by all segments of the population and generally serve residents from a one to three-mile service area. Community parks usually include areas designed for active recreation including sports fields or play courts as well as areas for passive recreation including trails and open space (Molinar and Rutledge, 1986).

Pocket parks are urban open spaces on a small scale, usually between ¼ and 1 acre in size, that provide a safe and inviting environment for surrounding community members. Pocket parks usually include small event spaces, play areas for children and spaces for relaxing or engaging in social activities (National Recreation and Parks Association, 2016). Linear parks offer urban populations changing vistas as they move through the linear landscape. Linear parks are often located along streams, rivers or waterfronts, although recently abandoned railway easements and infrastructure have been transformed into linear parks. Linear

parks are usually long narrow parks that contains trails systems that can used for physical activity or to connect areas of interest while allowing people move through places that they might not usually visit (National Recreation and Parks Association, 2016).

2.2.2 Defining Features

Defining features of parks include: Outer edges and entryways; active recreation areas; passive recreation areas; playgrounds; gathering areas; trails and pathways; green and open space, as well as structures and buildings (McCormack et al., 2010). Outer edges and entryways include all portions of the entrances and edges of parks. Outer edges and entryways are usually the first major features encountered by park visitors and are responsible for setting the tone for the park experience. Active recreation areas are defined by athletic fields such as soccer, baseball and softball fields (both natural and artificial turf), as well as hard surface courts such as tennis, basketball, or skate parks. Any area that is designed or intended for physical and active use by individuals or large groups in formal activities or events should be considered an active recreation area. Passive recreation areas include informal picnic grounds, open play areas, large lawns for mixed use, outdoor classrooms, active community gardens and other areas for individual or groups to engage in unstructured play and community events (McCormack et al., 2010). Playgrounds include all children's play areas and

consist of swings, slides, and other play equipment. Most playgrounds are intended for elementary aged children or younger. Playground areas also include surface areas, edging, and immediate supervision areas such as parent seating and gathering areas. Gathering areas are designed for social interaction and usually include benches (either single or grouped), gathering areas and plazas for individuals, small groups and larger public gatherings. Gathering areas may also include walls, boulders and other elements that are grouped to encourage sitting, gathering and community social interaction and engagement (McCormack et al., 2010).

Trails and pathways consist of pedestrian connections that include: paved multi-use trails, sidewalks, nature trails and soft surface pathways. Bridges and tunnels are also included in this category and are usually used to break edges and link parks or greenways in order to form larger trail systems. Green and open space encompasses both formal landscapes and natural areas that form the larger open spaces of parks and greenbelts. Formal landscapes may include ornamental trees, shrubs, and flowerbeds that are not native to the area and have been planted as part of the overall park design. Natural areas are areas that have been designated as protected and effort is usually made to prevent man made interventions from altering the native state of the park. Building and structures include major features such as restrooms, pavilions, chalets, and buildings located in parks to provide for public use and enjoyment.

2.2.3 Setting and Location

Parks and trail systems can be set or located in a variety of places including residential neighborhoods, dense urban developments, or rural settings. Parks are most often set on land that is either not suitable for residential and commercial development or areas of natural beauty that must be protected from demolition. Floodplains and waterways, which include river, creek and stream corridors, are popular settings for parks and trail systems. The Overton Park system is located along a tributary stream corridor in the Trinity River floodplain. Floodplains and waterways meet both of the above criteria for park settings because they are not suitable for development and the availability of water provides a rich ecosystem that should be protected from heavy man made interventions. Parks can be built in flood plains because most park features can be built to withstand being inundated by water for short periods of time during flooding events. Most park buildings and structures are built of rock, masonry, or metal materials that will not absorb or be destroyed by intermittent floodwater inundation. River and creek corridors offer ideal settings for trail systems because they act as a natural buffer between residential or commercial developments and offer a more natural setting for users to escape the hustle and bustle of the city. River and creek corridors provide a place for native plants and

animals to live within cities and offer trail users opportunities to observe and interact with them in a more natural setting.

Abandoned railroad and utility corridors are also becoming a very popular setting for linear parks and trail systems. These corridors offer long tracts of land that have been kept clear of vegetation and urban development to keep them functional as railways. These abandoned tracts of land provide opportunity to replace a loud industrial infrastructure, that historically create barriers and edges, with a quiet green space that allows for non-motorized transportation throughout a community. The recreational experience offered by parks and trail systems is not only determined by the type of activity, but also by the setting where the activity takes place. Physical attributes that can define the setting include: topography, vegetation, social factors, neighborhood character, and manicured or natural landscapes (ACSM Health and Fitness, 2012).

2.2.4 Uses

For a large part of the 19th century, parks and green space were generally ignored by city planners and developers and their uses were viewed as limited to recreational or leisure activities. Early city planning focused on the form of the city as a means to maximize economic production. Because cities were usually built to serve the local economy, many of the other aspects that contribute to creating a healthy community were ignored, leaving many cities lacking the open

space and park areas vital to the health of its residents. The development and popularity of urban parks dates back to the mid 1800's where Frederick Law Olmstead and Calver Vaux helped develop the influential Central Park in New York City (Rabare et al., 2009). In the late 1800's, the City Beautiful Movement and the Garden City Movement helped demonstrate the importance of open space in a city context (Kostof, 1991). Today's cities are focused on providing cultural and social benefits that create healthy places for us and other species to live, as well as creating economic success (Kwalski, 2009). The emphasis is now focusing on designing multi-use spaces where people can live, work and play while effectively living healthy lifestyles within an urban setting. Recently, many urban development projects in large cities across the country are being led by large park projects that serve as anchors or centerpieces (Kwalski, 2009). Examples of new developments that are centered around parks and trail systems at their core are Galisteo Basin Preserve in Santa Fe New Mexico and The Orange County Great Park in Irvine, California (Grooms, 2010).

Parks, open space, and connectivity via trail systems have become integral components in planning for and the design of healthy communities. Parks, open space, and trail systems within urban environments provide a range of benefits and uses for a city's resident population. Urban parks are now being viewed as an important part of the overall structure of urban and neighborhood development rather than just as recreation and leisure facilities (Rabare et al., 2009). These

recent changes in ideology are based on the growing evidence that parks and trail systems help to raise property values and create quality neighborhoods which in turn improves the economic capability of a given community (Potwarka et al., 2008). Parks and open space are also vital to the health of a city's residents. Recent research has acknowledged the potential of parks as an important element of the built environment for promoting physical activity and reducing obesity, cardiovascular disease and other sedentary or lifestyle related diseases (Potwarka et al., 2008). The design of cities and neighborhoods and the utilization of green and open space can encourage people to walk often and for fairly long periods of time (Degraaf et al., 2005). Residents are more likely to walk in their neighborhood if they have a favorable perception of their local environment, including parks and open space. Residents who walk more or engage in park activities are also more likely to engage in unplanned interactions with their neighbors and to form stronger social ties with neighbors (Lund, 2003). This form of behavior encourages healthy, safe communities where casual social interaction and physical activity can easily become part of residents daily activities. It is logical to assume that parks can play a vital role in both the economic and physical health of a community.

2.3 Health and Physical Activity

2.3.1 Health

Multiple definitions of health exist. Merriam-Webster defines health as "the condition of being well or free from disease" and "the overall condition of someone's body or mind" (Merriam-Webster, 2016). A more inclusive definition is from the World Health Organization, which is responsible for directing and coordinating health within the United Nations and providing leadership on global health. The World Health Organization defines health as "not merely the absence of disease," but "a state of complete physical, mental and social well-being" (WHO, 1948). This definition has not changed since 1948. Edlin (2012) points out that health is a quality of life that is difficult to define and virtually impossible to measure.

Often addressed alongside health is the concept of wellness, and sometimes, the definition of one is inclusive of the other. For example Edlin (2012) describes health as "a sense of optimum well-being – as state of physical, mental, emotional, social, and spiritual wellness." Widespread use of the term wellness began in the 1950's, though the wellness movement blossomed in the 1970's. Halbert Dunn, who is considered one of the fathers of wellness, describes the term as "an integrated method of functioning which is oriented to maximizing

the potential of which an individual is capable, within the environment where he is functioning" (Boissonnault, 2010). Various authors describe different models and dimensions of health and wellness. The National Wellness Institute utilizes Dr. Bill Hettler's Six Dimensions of Wellness, which include: Occupational, Physical, Social, Intellectual, Spiritual, and Emotional (NWI, 2016).

Both health and wellness are dynamic processes that can change quickly, as every choice we make potentially affects health and wellness (Edlin, 2012). Health is not something that can be achieved and forgotten, but is an ongoing process of which individuals must remain mindful. Understanding the complexity of health and its related factors through the literature review helps in identifying the impacts that parks and trail systems have on health and wellness.

2.3.2 Types of Physical Activity

Physical activity is defined by the World Health Organization (2015) as any bodily movement produced by skeletal muscles that requires energy expenditure. Physical activity includes sports, exercise and other activities such as playing, walking, doing household chores, gardening, and dancing (World Health Organization, 2015). Physical activity is categorized based on either type or intensity level. Intensity refers to the rate at which the activity is being performed. It can be thought of as how hard a person works to do the activity. The three recognized categories of physical activity include light intensity,

moderate intensity, or vigorous intensity (Harvard School of Public Health, 2016). The intensity of physical activity is measured using the metabolic equivalent of task (MET) which is a physiological measure of energy cost or calories burned by the body during activity. One MET is the energy equivalent expended by an individual while seated at rest. While exercising, the MET equivalent is the energy expended compared to rest so MET values indicate the intensity. An activity with a MET value of 5 means you are expending five times the energy or number of calories than you would at rest (Bushman, 2012). Light intensity physical activity is done at a work level of less than three METS, which usually means expending less than 3.5 calories per minute. Moderate intensity physical activity is done at a work level between three and six METS, which expends between three and a half to seven calories per minute. Vigorous intensity physical activity is done at a work level of greater than six METS, which expends more than seven calories per minute (Bushman, 2012).

The intensity of different forms of physical activity varies from person to person and largely depends on an individual's relative level of fitness. Examples of light intensity physical activity include walking slowly, sitting using computer, standing doing light work such as cooking or washing dishes, fishing, and playing most instruments. Examples of moderate intensity physical activity could include: brisk walking, dancing, heavy house hold cleaning, mowing the lawn, or light bicycling. Examples of vigorous intensity physical activity could be:

running, fast cycling, fast swimming, shoveling, moving heavy loads or sports such as basketball or soccer. The examples above categorize general activities and the related intensity levels for the average healthy person and can be viewed in Figure 2-1. However, they are not absolute as they vary based on an individuals' fitness level. For example, walking briskly is categorized as moderate intensity, but it could be considered vigorous to a person with a low level of fitness such as an elderly or obese person. Inversely, it could be considered light to a person with a high level of fitness such as an athlete or marathon runner.

Physical activity can also be categorized into four main types including: aerobic, muscle-strengthening, bone-strengthening, and stretching (CDC, 2012). Aerobic activity requires moving your large muscles, such as those in your arms and legs, for extended period of time. Examples of aerobic activity include: running, swimming, walking, bicycling, dancing, and doing jumping jacks. Aerobic physical activity also is referred to as endurance activity because the goal

Light Intensity Physical Activity <3.0 METs	Moderate Intensity Physical Activity 3.0–6.0 METs	Vigorous Intensity Physical Activity >6.0 METS
• Walking—slowly • Sitting—using computer • Standing—light work (cooking, washing dishes) • Fishing—sitting • Playing most instruments	• Walking—very brisk (4 mph) • Cleaning—heavy (washing windows, vacuuming, mopping) • Mowing lawn (power mower) • Bicycling—light effort (10–12 mph) • Badminton—recreational • Tennis—doubles	• Hiking • Jogging at 6 mph • Shoveling • Carrying heavy loads • Bicycling fast (14–16 mph) • Basketball game • Soccer game • Tennis—singles

Figure 2-2 Physical Activity Intensity - Source (Harvard School of Public Health, 2016)

is to get the heart rate up and sustain this state as long as possible. Aerobic physical activity requires muscle tissue to continuously use oxygen, which makes the heart beat faster than usual and breathing rates increase. Over time, regular aerobic physical activity increases heart and lungs strength and the ability of these organs to work more efficiently. Aerobic physical activity benefits overall health by improving stamina and burning calories, which helps to keep body fat levels down (Lewis and Hennekens, 2016).

The other types of physical activity such as muscle strengthening, bone strengthening, and stretching benefit the body in other ways. Muscle strengthening physical activity improves the strength, power, and endurance of muscles (Warburton 2006). Examples of muscle strengthening physical activity include: body weight exercises such as pushups or sit-ups, lifting weights, climbing stairs or hills, and digging or shoveling. With bone strengthening physical activities, the feet, legs, or arms support the body's weight, and the muscles push against bones causing bones to flex. The flexing of the bones initiates body processes to reinforce the strength of the bones by adding calcium layers. This response helps to strengthen the bones that the muscles were acting upon, which helps reduce the risk of injury and osteoporosis. Running, walking, jumping rope, and lifting weights are examples of bone-strengthening activities.

Muscle strengthening and bone-strengthening physical activity can also be aerobic, depending on whether they cause the heart and lungs work harder than

usual. Running, for example can be considered an aerobic physical activity, a muscle strengthening physical activity and a bone strengthening physical activity. The last type of physical activity is stretching, which helps improve flexibility and the ability to fully move the joints of the body. Reaching to touch the toes, doing side stretches, and doing certain yoga exercises are examples of stretching.

2.3.3 Health Benefits of Physical Activity

According to the U.S. Department of Health and Human Services, men and women who engage in regular physical activity experience statistically significant and clinically important reductions in the risk of dying from coronary heart disease, the leading cause of death in the United States (Lewis, 2016). Physical activity also reduces the risks of developing diabetes, high blood pressure and colon cancer. Physical activity has also been shown to enhance mental health and improve muscle, bone, and joint health (Lewis, 2016). As many as 250 000 deaths per year in the United States and 3.2 million deaths per year globally are attributable to a lack of regular physical activity (World Health Organization, 2015).

In addition, longitudinal studies that followed large groups of individuals for many years have documented the protective effects of physical activity for a number of chronic diseases, such as non–insulin-dependent diabetes, hypertension, osteoporosis, and colon cancer (U.S. Public Health Service,1996).

Even small increases in physical activity, through change in occupation or recreational activities, are associated with a decrease in mortality (Paffenbarger et al., 1993). Despite this evidence, however, the vast majority of adults in the United States remain effectively sedentary; less than one-third of Americans meet the minimal recommendations for activity as outlined by the CDC, ACSM, and AHA expert panels (Myers, 2003).

A sedentary lifestyle is one of the 5 major risk factors (along with high blood pressure, abnormal values for blood lipids, smoking, and obesity) for cardiovascular disease, as outlined by the American Heart Association (2012). Evidence from many scientific studies shows that reducing these risk factors decreases the chance of having a heart attack or experiencing another cardiac event, such as a stroke (Myers, 2003). Regular physical activity has a favorable effect on many of the established risk factors for cardiovascular disease. For example, physical activity promotes weight reduction and can help reduce blood pressure. Physical activity can also reduce "bad" (LDL) cholesterol levels in the blood, as well as total cholesterol, and can raise the "good" cholesterol (HDL). In diabetic patients, regular physical activity favorably affects the body's ability to use insulin to control glucose levels in the blood (Lewis, 2016). The health benefits of a physically active lifestyle when compared to a sedentary lifestyle are undeniable and numerous studies have and continue to research and provide strong evidence to back these claims.

"Benefits of Regular Physical Activity on Cardiovascular Risk Factors Include:

1. Increase in exercise tolerance
2. Reduction in body weight
3. Reduction in blood pressure
4. Reduction in bad (LDL and total) cholesterol
5. Increase in good (HDL) cholesterol, and
6. Increase in insulin sensitivity" (Myers, 2003)

There are a number of physiological benefits of physical activity; examples are improvements in muscular function and strength and improvement in the body's ability to use oxygen. As one's ability to transport and use oxygen improves, regular daily activities can be performed with less fatigue. There is also evidence that physical activity training improves the capacity of the blood vessels to dilate in response to exercise or hormones, consistent with better vascular wall function and an improved ability to provide oxygen to the muscles during exercise (Myers, 2003). Studies measuring muscular strength and flexibility before and after physical activity programs suggest that there are improvements in bone health and ability to perform daily activities, as well as a lower likelihood of developing back pain and or disability (Warburton, 2006).

A 2013 research article titled "Long Term Health Benefits of Physical Activity – A Systematic Review of Longitudinal Studies" reviewed studies that focused on the relationship of physical activity and health. The article looked at studies with more than 500 healthy participants. The review narrowed the results down to 18 studies in which a total of 292,278 subjects were involved at baseline

(268,885 subjects at follow-up). Overall, the results of the reviewed articles provided a general view about the longitudinal relationship between physical activity and the incidence of non-communicable diseases and health problems. The results of the reviewed studies indicate that physical activity seems to be an important factor that can have beneficial effects for the reviewed non communicable diseases, weight gain and obesity, coronary heart disease and type 2 diabetes mellitus, the risk factors of weight gain and obesity and the age-related diseases dementia and Alzheimer's disease (Reiner et al., 2013).

2.3.4 Benefits of Outdoor over Indoor Physical Activity

Outdoors physical activity seems to have several benefits over indoor physical activity and this chapter reviews and discuss some of these benefits. Physical activity can be done indoors, in health clubs or gyms, but the failure to continue with indoor physical activity routines on a long-term basis is well recognized. For example, 40%-50% of individuals terminate gym membership within a year of joining (Coon et al., 2011). Evidence suggests that long-term adherence to exercise initiatives conducted in outdoor natural environments or urban green spaces may be superior to that of indoor exercise interventions (Bird 2004).

Recently there has been an increasing awareness of the positive impact of exposure to natural environments on mental wellbeing (Coon et al., 2011).

Experimental research has demonstrated that exposure to views of nature can improve people's health and wellbeing by providing restoration from stress and mental fatigue, and this has led to suggestions that performing physical activity in nature may have additional benefits above and beyond those experienced following physical activity done in an indoor environment (Coon et al., 2011). Initiatives setup to increase physical activity in green spaces have been linked with improvements in social networking and feelings of connectivity and companionship, an increased appreciation of nature, improvements in self-esteem, and a means of escape from the stresses of modern life (Peacock et al., 2007). These health benefits could have important effects on the sustainability of physical activity routines while also for informing people about the importance of protecting the natural environment and the need to encourage sustainable development.

Several narrative reviews have been published in which the benefits of exercising outside are summarized. Coon et al. (2011) adopted well tested procedures from the health science area and performed a systematic review of the available evidence from comparative studies. This provides an objective means of explaining the value of outdoor green spaces in motivating physical activity and in discussing mental and physical wellbeing (Lee and Moudon, 2004). A 2011 research study in the United Kingdom systematically reviewed 11 trials comparing the effects on mental and physical wellbeing, health related quality of

life and long-term adherence to physical activity, of participation in physical activity in natural environments compared with physical activity indoors. The study found that most trials showed an improvement in mental well-being: compared with exercising indoors, exercising in natural environments was associated with greater feelings of revitalization, increased energy and positive engagement, together with decreases in tension, confusion, anger and depression (Coon et al., 2011). Participants also reported greater enjoyment and satisfaction with outdoor activity and stated that they were more likely to repeat the activity at a later date (Coon et al., 2011).

Other benefits to outdoor physical activity over indoor physical activity include: economic value, vitamin synthetization, and mood or self-esteem improvements. Most parks and trail systems do not charge entry or usage fees. Most all indoor fitness centers or gyms charge a fee for use, usually monthly or yearly memberships are required. Over time the amount of money spent on memberships adds up and in contrast the money saved by choosing parks or trail systems as a setting for physical activity could be considered an economic value. Physical activity done in parks or trail systems provides an opportunity to reap the benefits offered by the sun. While unprotected overexposure to the sun's ultraviolet rays can increase your risk of skin cancer, the many benefits of sunlight should not be overlooked. The human body uses sunlight to synthesize and create essential vitamins. When the suns' rays hit the skin, it creates vitamin

D3, which is important to bone health and metabolic function (Holick, 2008). In addition, exposure to sunlight during the day can help you sleep better at night, improve immune function and increase endorphin production. Endorphins are one of the main hormones that are responsible for producing positive feelings and also help reduce pain (Bird, 2004). There are many benefits of outdoor physical activity, offered by parks and trail systems that that cannot be attained by indoor physical activity.

2.4 Health Impacts of Parks and Trail Systems

Parks and trail systems provide opportunities for physical activity during leisure, and recent research shows that leisure, not paid work or housework, is now the part of life where the most physical activity occurs. People move their bodies either because they have to or because they want to. The necessity of moving one's body in daily life has declined dramatically, due to technology, helping to produce an epidemic of obesity (Godby and Mowen, 2010). People commonly use parks and trail systems in ways that involve physical activity and contribute to their mental and physical health. Several studies show that users of parks and trail systems are physically active during their park visits (Warburton, 2006; Shoes et al., 2010; Ross et al., 2012). Such findings hold true for users of all age groups. A study of adult park users in Cleveland, Ohio found that 69% of

parks users reported moderate or high levels of physical activity during their park visits. Park users reported an average visit lasting almost 2 hours, with walking being the most popular activity done in the park (Godby and Mowen, 2010).

2.4.1 Beneficial Features

Parks and trail systems contain many features that help facilitate opportunities to improve the health of users. Well-designed parks and trails are and should be viewed as valued parts of our environment. Research examining the connection between parks, trail systems, and health has helped identify the value that parks provide to people of neighborhoods or communities. Parks and trails can promote physical activity and community engagement, as well as provide both environmental and mental health benefits. When well-designed, parks have been shown to reduce stress and foster community interaction. They can also protect sensitive lands such as flood plains and steep slopes and provide green space that can help reduce air and water pollution as well as reducing urban heat island effects.

Parks and trails can provide resources most communities need when addressing many of today's public health problems (CDC, 2013). Parks and trails can improve health in several ways including:

1. Increased physical activity- walkable access to appropriate sites motivates people to participate in physical activity and to do so more frequently;

2. Improved mental health- parks can serve as a venue for stress reduction;
3. Environmental benefits- parks can reduce air and water pollution, protect hazard areas (e.g., flood plains, unstable slopes) from inappropriate development, and mitigate urban heat islands;
4. Community interaction- parks can provide meeting places for neighbors;
5. Reduce injury- parks and trails can provide safe spaces for people to play and exercise, away from busy streets and commercial zones.

People who are exposed to the greenest environments also have the lowest levels of health inequality among low-income households (CDC, 2013). Physical environments that promote good health, like parks and trail systems, might also be a significant factor in reducing socioeconomic health inequalities.

Existing evidence has demonstrated that the presence of certain park features is linked with light, moderate, and vigorous physical activity (Kacznski et al., 2008). For example, parks that feature paved trails, sports fields, open mixed use fields, playgrounds, as well as support features such as restrooms and water fountains are more likely to attract higher visitation and contribute to increased levels of physical activity than parks without these features (Godby and Mowen 2010; Kacznski et al., 2008; Gobster, 2005). In addition to physical features, location should be considered an environmental feature impacting the health levels of neighborhoods and communities. Parks and trail systems located near

community centers and schools have been shown to increase park use and participation in physical activity.

2.4.2 Detrimental Constraints

Even though parks and trail systems can be important health-encouraging components of communities, in some cases they can also create community concerns or constraints. Depending on location, some parks may be viewed as a place for crime or illegal activity to take place. Other concerns that could be viewed as constraints include injuries at the park or when people are traveling to access the park, exposure to weather elements, or lack of features and amenities that encourage health.

2.5 The Overton Park System

2.5.1 History

The Overton Park System is located within the Trinity River floodplain in Fort Worth Texas, which includes its immediate tributaries, and is a prototypical example of a linear park.

Figure 2-3 Park System Location Map - Source (GIS)

The Overton Park System is essentially an extension of the larger Trinity Trail System that follows the Trinity River and its tributaries throughout the city of Fort Worth and makes up a piece of the North Texas Regional Veloweb. Floods were relatively common in this low area until completion of the Benbrook dam in 1952.

The land that the park system and adjacent neighborhoods occupy was once a piece of the Edwards Ranch, which worked the land and raised cattle in the area as early as the 1850's.

Overton and Foster parks form a linear park system that runs two and a half miles in mostly a north-south direction through the neighborhoods of Overton Park, Foster Park, Westcliff West, and Tanglewood. These neighborhoods were developed in the 1950's and consist of mostly one story ranch style homes that complement the history of the land upon which they sit. The neighborhoods today are affluent and have strong identities and established character.

Tanglewood, which is the neighborhood on the north end of The Overton Park System, is .634 square miles in size, has a population of 2,014, median household income of $77,003 per year, median house value of $502,265, and median age of 35 years for males and 37 years for females (www.city-data.com, 2016).

Overton Park, which is the neighborhood that borders most of the west side of the Overton Park System, is .855 square miles in size, has a population of 2,820, median household income of $82,156 per year, median house value of $497,945, and median age of 40.4 years for males and 42.5 years for females (www.city-data.com, 2016).

Westcliff West, which is the neighborhood that mostly borders the east side of the Overton Park System, is .618 square miles in size, has a population of

2,777, median household income of $80,165 per year, median house value of $324,520, and median age of 33.4 years for males and 38.4 years for females (www.city-data.com, 2016).

Foster Park, which is the neighborhood on the south end of The Overton Park System, is .604 square miles in size, has a population of 1,785, median household income of $85,961 per year, median house value of $332,465, and median age of 37.6 years for males and 43.4 years for females (www.city-data.com, 2016).

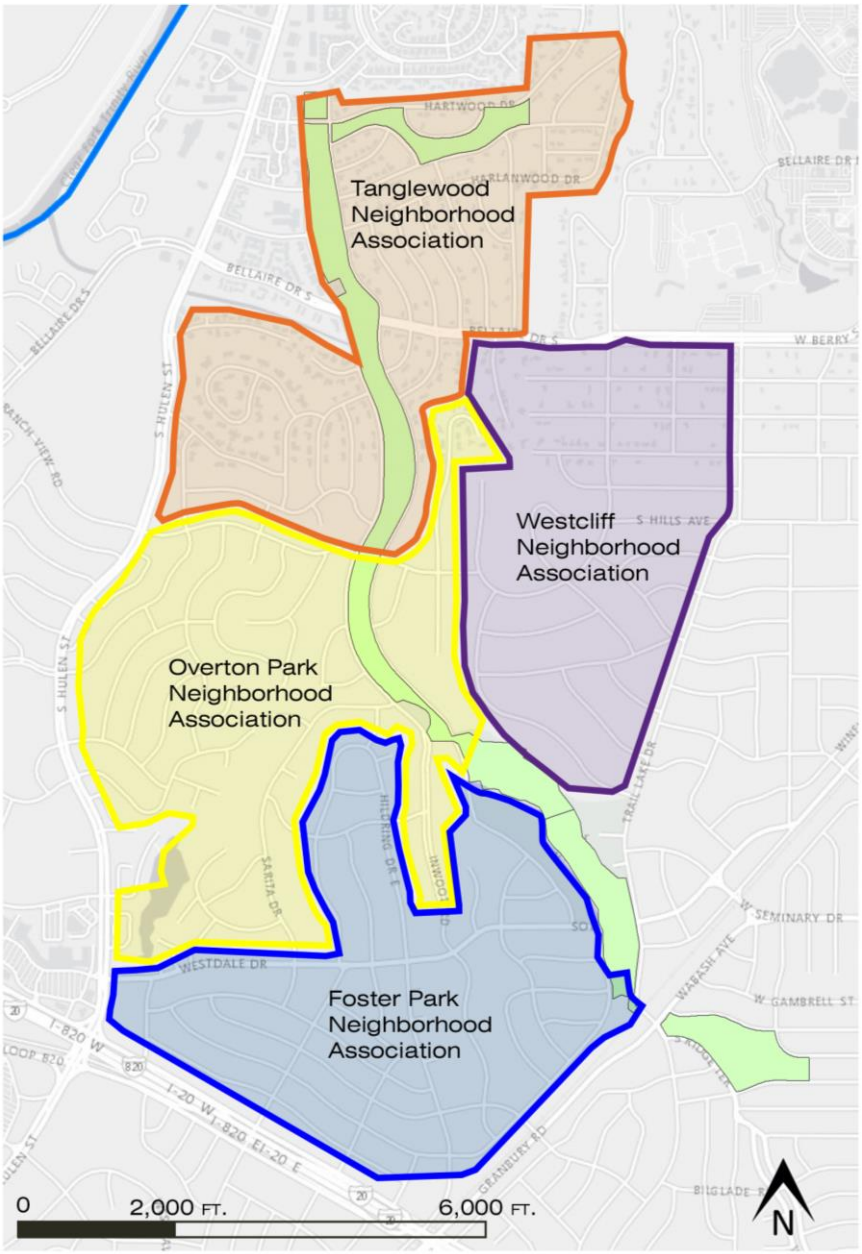

Figure 2-4 Neighborhood Association Map - Source (GIS)

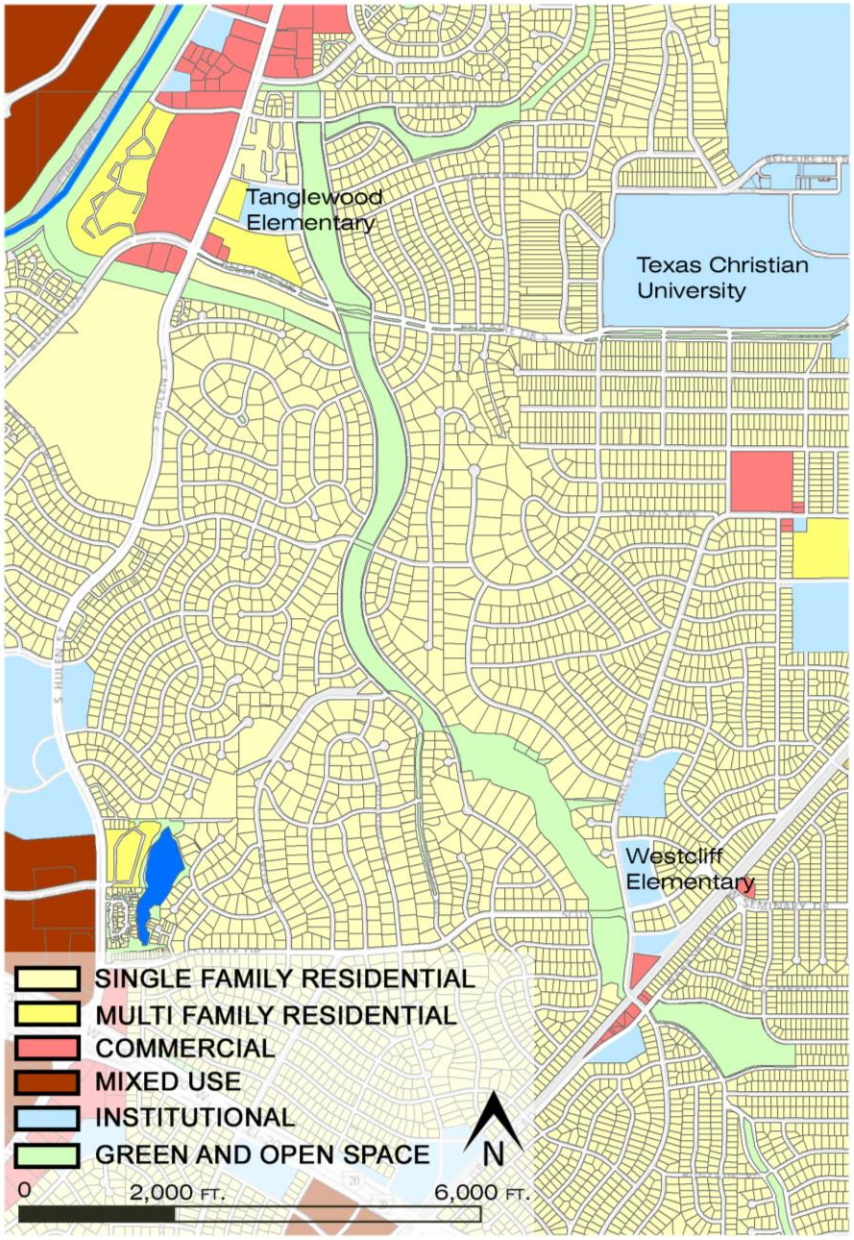

Figure 2-5 Land Use Map - Source (GIS)

2.5.2 Features and Amenities

The Overton Park System has many features and amenities that provide opportunities for the adjacent neighborhoods and community to enjoy. The two

dominant and most defining features of the Overton Park System are the trail system and the riparian corridor along the creek. A paved hike and bike trail (TH8 of the Trinity Trail System) runs the entire distance of the Overton Park System and connects it to the main Trinity Trail System and Trinity River via a three-quarter mile connecting trail (TH3), which crosses under South Hulen Street. Along the main section of Overton Park, the trail system runs along both sides of the creek. The trail crosses the creek and connects to itself via pedestrian bridges in several places throughout the park system. Throughout most of Foster Park and on the north end of Overton park the trail only runs on one side of the creek.

The creek flows from south to north entering the park system at the south end of foster park and flowing north through a duck pond, under South Drive, and follows a winding route through the rest of Foster Park. The park system transitions from Foster Park to Overton Park as the creek goes under Overton Park Drive East. The creek goes through a series of falls and check dams on the southern end of Overton Park and runs through the linear park section bordered by Overton Park Drive on the east and Inwood Road on the west. The creek continues north through Overton Park until it takes a hard turn west and leaves the park just south of Bellaire Drive South. The stretch of park that lays north of Bellaire Drive drains to the south through a natural drainage channel that contains several sections of grass swales. At the northern end Overton Park, the park and

trail system makes a ninety degree turn east and continues about a half mile along the natural drainage.

Foster Park forms the south end of the system and is split into sections by South Drive, which runs east and west through the park. On the south end of Foster Park, the creek is dammed to form a duck pond which is approximately 500 feet long and varies between only 50 to 100 feet wide. To the east of the duck pond is an open grass field and a small concrete pad with basketball goals that provides mixed recreational opportunities. On the north end of the open grass field there is a small parking lot with approximately 10 spaces and simple playground area for young children. On the north side of South Drive, a larger parking lot with approximately 45 spaces provides access to a larger more complex playground, a body weight physical activity area, and the trail system that sits just north of the parking lot. The playground to the north of the parking lots offers more variety in the size of the equipment, which allows the structures to accommodate older children also.

From the parking lot, the trail system provides the option to go near the playground or to cross the creek via a pedestrian bridge, shown in Figure 2-5. On the west side of the creek, opposite the playground, is group of body weight physical activity equipment that borders the trail. Westcliff West Elementary School is located directly across Trail Lake Drive to the east of this playground

and physical activity area. Both trails continue north and converge together after

Figure 2-6 Foster Park Trail and Pedestrian Bridge.

another pedestrian bridge provides a connection. The trail continues north and west through a heavily forested area, while the creek meanders through the forested area and crosses under the trail several times. About 1,500 feet past the playground, the forested area along the trail opens up and reveals a secluded open grass field that is approximately 250 feet by 150 feet and is bordered on all sides by the heavy forest. Beyond the secluded field the trail continues northwest, through another forested area until the park ends at Overton Park Drive East. The north end of Foster Park consists of the paved hike and bike trail through heavily forested areas, as well as unmaintained dirt trails following the creek, and

unprogrammed open space. The northern border of Foster Park is defined when the trail crosses the road at a crosswalk and the creek passes under a bridge, at this point the system transitions into the south end of Overton Park. Other amenities of Foster Park include a few benches and picnic tables scattered along the trail and near the playground. No formal structures or buildings exist in Foster Park.

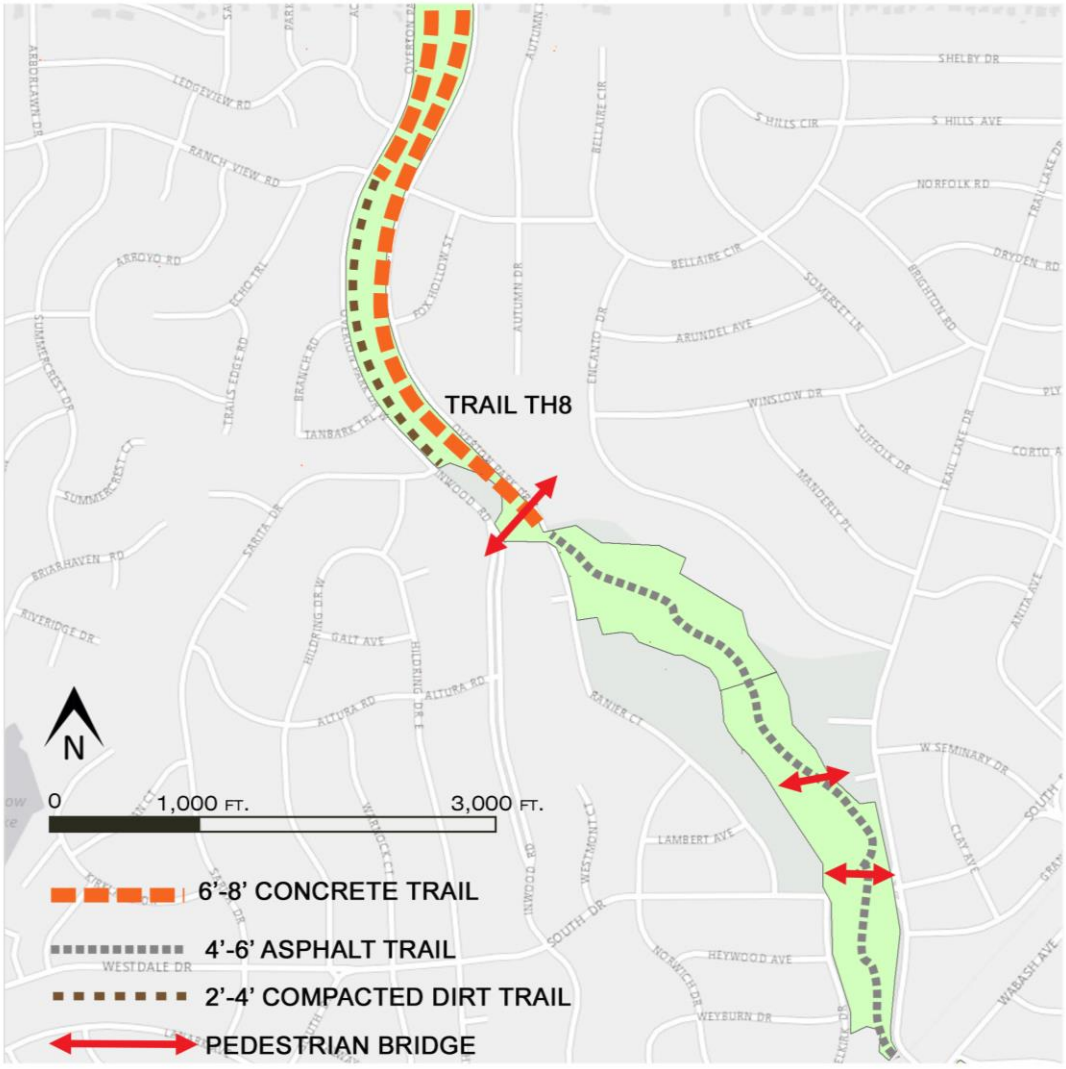

Figure 2-7 Trail Circulation South - Source (GIS)

The southern end of Overton Park, between the crossing at Overton Park Drive and Ranch View Road, is narrow with the paved trail only running on the west side of the creek. An unpaved dirt trail exists on the east side of the creek, and both trails roughly follow the creek and pass through the narrow strips of park that vary between 50 and 100 feet in width on either side of the creek. The creek comes in and out of view from the trail due to heavy foliage and large trees that line the creek bank, and the only built amenities in this stretch of park are benches that are scattered along the trail in small clearings. The creek in this section of the park is channelized and banks are reinforced by gabion walls in areas prone to erosion, see Figure 2-8.

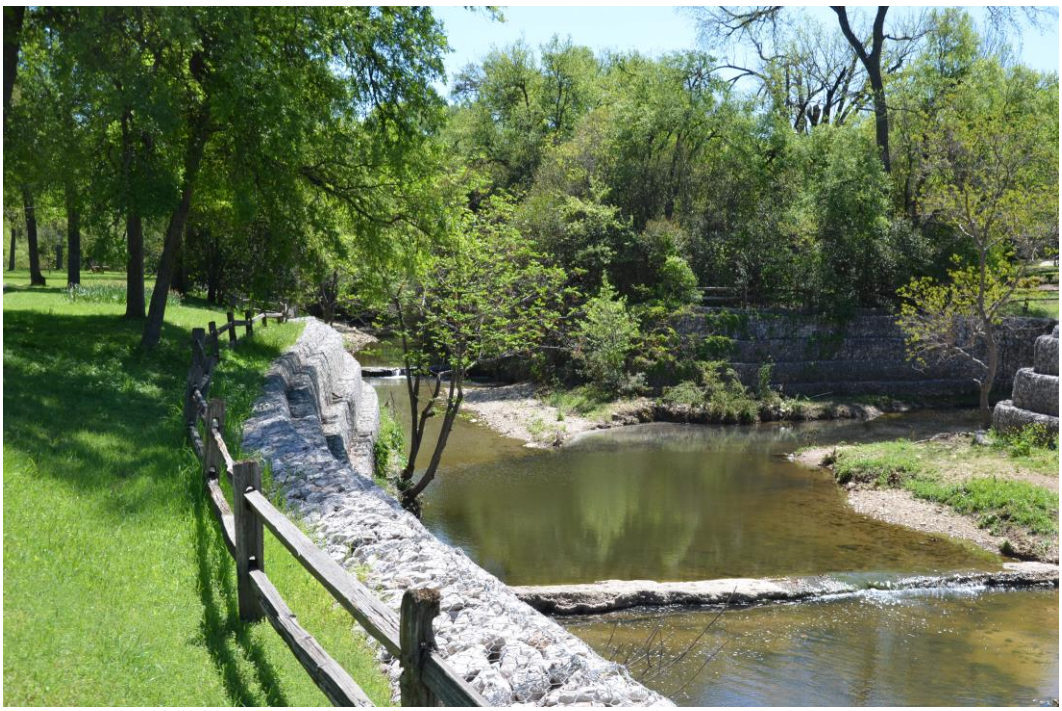

Figure 2-8 Creek Condition in Overton Park

North of Ranch View Road, the trails are paved on both sides of the creek; and due to a long bend in the park, some of the open spaces and clearings become wider and measure up to 230 feet in width on the west side of the creek. Another pedestrian bridge links the two trails together before the creek approaches Bellaire Drive South and makes a hard turn to the west, leaving the park under Overton Park Drive West. The section of park between the north end of the creek and Bellaire Drive South consists of a large clearing on the west side. The clearing houses a piece of public art, and a grove of large trees on the east.

North of Bellaire Drive South, paved trails continue on both sides of the park and are divided by a more natural drainage swale that flows south into a headwall at Bellaire Drive and goes into the city's sanitary sewer system. This section of the park consists of both trails moving through groves of mature trees that are slightly scattered though grass clearings. Across from Tanglewood Elementary School, there is a small playground and clearings for sports and recreation activities

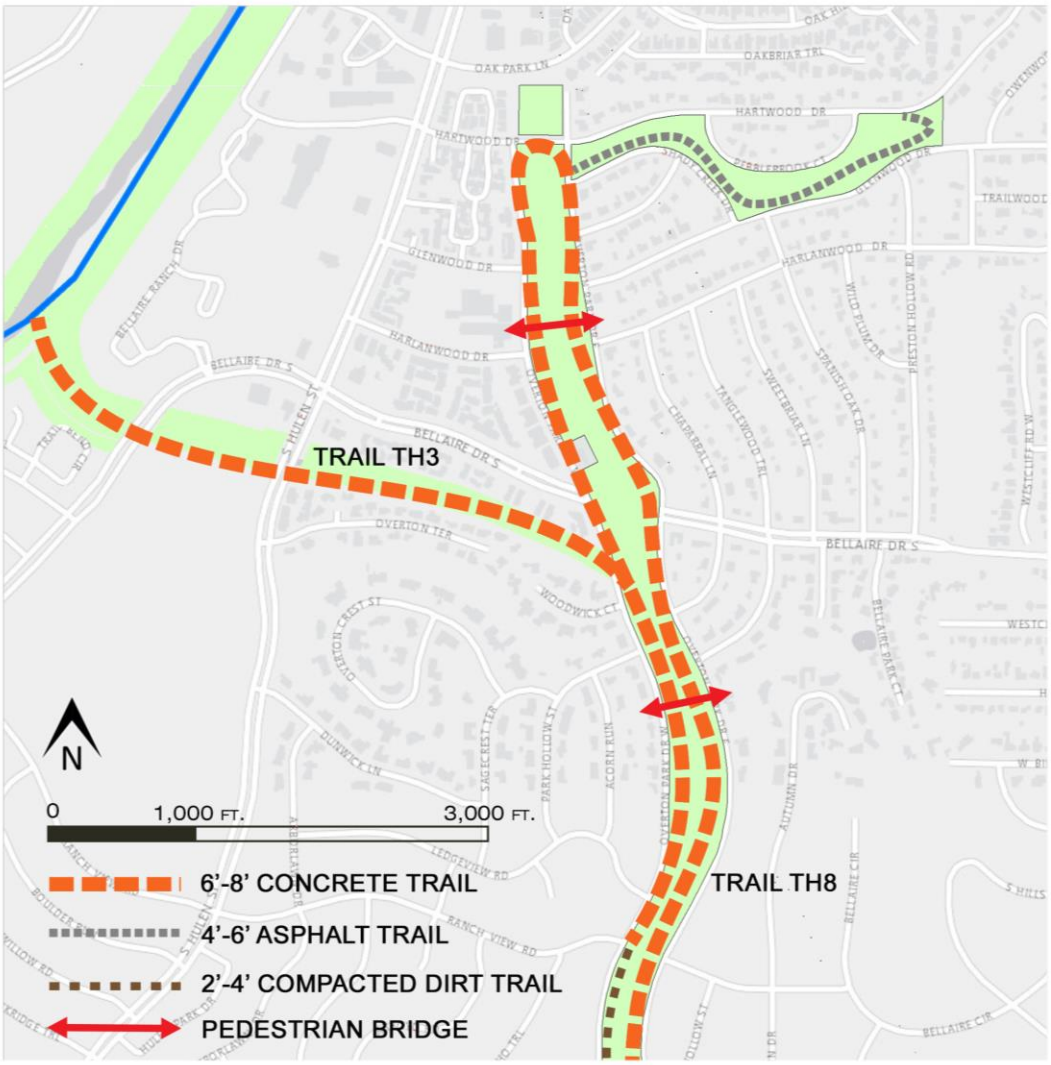

Figure 2-9 Trail Circulation North – Source (GIS)

. A pedestrian bridge crosses the swale here and provides connection between the trails when water is flowing. The park continues north to Hartwood Drive, where the trail and drainage turn almost due east. Directly to the north of Hartwood Drive the park features two formal tennis courts and a small parking lot with 10 spaces, see Figure 2-10. The section of the park that runs east here is

very narrow, between Hartwood Drive and Shady Creek Drive, with a paved trail on only one side of the drainage and runs through dense groves of mature trees.

Figure 2-10 Overton Park Tennis Courts and Amenities

The last section of The Overton Park System discussed in this study is the section of trail, named TH8, between Overton Park and the Trinity River to the west. This section of trail follows the creek which is mainly channelized in this section. The creek bank in this stretch is mainly man made levees with gabion reinforcement. The creek roughly follows Bellaire Drive South westward to meet the Clear Fork of the Trinity River. The trail runs only on the south side of the creek, and is bordered to the south mainly by the rear fences of residential lots. The trail and creek cross under South Hulen Street and Bellaire Drive South

before the confluence with the Clear Fort of the Trinity River and the Trinity Trail System. The trail and channelized creek are the only amenities in this section of The Overton Park System, see Figure 2-11.

Figure 2-11 Connecting Trail (TH3) and Creek Condition

2.6 Summary

The literature clearly demonstrates the health benefits of physical activity as well as the benefits of time outdoors in a natural setting. Outdoor parks and trail systems can allow for a merger of these two health and wellness components. Additionally, ease of access to parks and trail systems can allow for incorporation

of outdoor activity and interaction into daily routines for residents. The Overton Park system is a valuable commodity for the surrounding communities. Approximately 9,396 people live the neighborhoods bordering the park; thus, the potential for access and utilization of the park is great. In a society where the majority of people live a sedentary lifestyle and spend most of their time indoors, the value of green space offered through parks and trail systems as a contributor to health and wellness cannot be overlooked. The next chapter discusses and reviews the methodology used in the research study.

Chapter 3 Methodology

3.1 Introduction

This chapter focuses on the methods used to design the research study "Health Impacts of Parks and Trail Systems: Lessons Learned from The Overton Park System." The primary research method entails the use of a quantitative approach to study the health impacts of parks and trail systems (Deminig and Swaffield, 2011). This chapter reviews basic procedures in the research process including the quantitative approach of the research design. The chapter concludes with discussion of the significance of the research as well as limitations, potential bias, and errors.

3.2 Quantitative Approach

The purpose of employing a quantitative approach is to assess the health impacts of parks and trail systems with empirical methods while providing findings that communicate numerical data to the general public. The empirical approach typically starts with systematic review and documentation of current literature to further understand the health impacts offered by parks and trail systems. Data collection primarily done through the use of the online survey. Research opportunities are highlighted through review of current literature and

findings revealed through data collected. Understanding this approach is important in determining if parks and trail systems contribute health benefits to adjacent neighborhoods. Methods from city planning and landscape architecture practice inform the research design on how parks and trail systems impact the health of residents. This research is grounded by analysis of current literature in comparison with demographic data available to the public and data generated from an online survey of residents.

3.3 Research Design

The primary objective of this study is to explore the health impacts that parks and trail systems have on residents of adjacent neighborhoods. Part of the study's purpose is to evaluate how residents' perceptions of the park system affect their physical activity levels. Health indicators generated through the literature review guide the research questions and focus of the study. The review, organization, and analysis of these health indicators lead to the direction of the research.

The research design section of this thesis underlines what the actual research design is and the variables that are important in analyzing the data from the literature review, secondary sources, and generated by the survey. As previously stated, the design of this research identifies the health benefits or

constraints contributed by The Overton Park System in Fort Worth, Texas. The Overton Park System was chosen to study because it offers accessibility to the researcher, availability of secondary data for analysis, a prototypical trail system with four established neighborhoods as its edges, and connections to a larger more complex system (Lynch, 1960). The setting, features, and amenities of The Overton Park system represent a model park and trail system that the methodology of this research requires. The University of Texas at Arlington Institutional Review Board approval letter and related forms can be found in Appendix A.

3.3.1 Study Population

The target study population for this research consist of people over eighteen years of age that live within in a 1 mile of The Overton Park System. The residents of the four neighborhoods that border The Overton Park System where asked to participate because they met the target population criteria. Participants were recruited from members of Overton Park, Foster Park, Westcliff West, and Tanglewood neighborhood associations, through email blasts, containing a cover letter and link to the online survey. The blast was sent by the individual associations and through postings on neighborhood association online message boards. According to www.city-data.com (2010) the populations of

these four neighborhoods are as follows: Overton Park 2,820, Foster Park 1,785, Westcliff West 2,777, and Tanglewood 2,014. The total target population of residents within the study area equals 9,396 residents, although this number includes people under 18 years old that are not eligible to participate in the study.

3.3.2 Study Location

As is broadly explained in Chapter Two, the study location for this research is The Overton Park System in Fort Worth, Texas. The Overton Park System consists of Overton Park, Foster Park, and the trail system that connects them to the Trinity Trail System, and was chosen for this research due to its features, amenities and setting that make up a prototypical linear park and trail system as well as its availability to the researcher. The Overton Park System is a linear park system that is bordered by four affluent and established neighborhoods including Tanglewood, Overton Park, Westcliff West and Foster Park, which house residents out to approximately 1.5 miles from the park system. The Overton Park System is located approximately 5 miles southwest of downtown Fort Worth. The park system follows a creek and its linear floodplain through four affluent neighborhoods that were developed in the 1950's. The Overton Park System provides pedestrian and bicycle connection to the larger Trinity Trail Park System that runs throughout Fort Worth.

Figure 3-1 Study Location Map 1

3.3.3 Data Collection Methods

The primary data collection tool is a three-part online survey designed to collect descriptive statistics and frequencies to report on the impacts park features, amenities, proximity, accessibility and perception have on resident's physical activity levels. Residents of four neighborhood associations are asked to complete an online survey created through Qualtrics software. Qualtrics is a robust survey tool that allows the researcher to create and manage surveys in an online format (Snow and Mann, 2013). The survey is intended to investigate residents' physical activity level and park usage. Approval from The University of Arlington Institutional Review Board was received prior to sending the survey and related materials out to participants. The survey results, in conjunction with research conducted in the literature review, are used to better understand and validate the health value offered by parks and trail systems and to help make a case for increased implementation and inclusion of parks and trail systems in future development design.

3.3.3.1 Survey

The three-part online survey was used as the primary data collection tool of this research study. The survey was created by the researcher for the purpose of collecting data related to physical activity levels, park usage habits, and park

perceptions of the study population. The survey consists of three sections that are designed to collect data that are analyzed to answer the study's research questions. A survey questions were influenced by reviewing a survey used in similar study in Kansas City in 2013 (Kaczynski et al., 2013). The first section collects demographic statistics of the study population through the use of short answer, multiple answer, and Likert scale questions (Likert, 1932). Data collected in the first section includes: gender, age, body height and weight, limiting disabilities, and proximity and access to the park. The second section of the survey collected physical activity and park usage data of the study population through the use of short answer and multiple answer questions. Data collected in this section includes frequency and duration of light, moderate, and vigorous physical activity, percentage of physical activity done in The Overton Park System, as well as activities and accompaniment statistics. The last section of the survey collected data related to park features, amenities and how the perception of the features or amenities impact park usage. Likert scale questions were used to generate the data in this section. The survey also contained one multiple answer and 3 short answer questions. See Appendix B for a hard copy of the online survey.

3.3.3.2 Passive Observations

A systematic observation of the physical environment including presence and qualities of features such as number and quality of man-made amenities, quality of trail surface, access points to park, trail, and creek was used to collect data and hypothesize about park usage and physical activity patterns (Brownson et al, 2009; Francis and Marcus, 1998). One of the primary areas of focus during passive observation data collection is to study the presence and quality of trails throughout the park system. Passive observation was also used to identify and document micro-scale environmental variables of The Overton Park System and examine their relationship and functionality within the context of the neighborhoods. Passive observation is also used to observe activities of the study population and their interaction with and through the study location.

Passive observation of each section of The Overton Park System started by walking the entire distance and documenting its micro-scale environmental variables as well as its relationships within the context of the study location. Beneficial features as well as detrimental constraints were documented and photographed to help describe the overall experience of moving through The Overton Park System, and its relationships with the four bordering neighborhoods.

3.3.3.3 Secondary Data

Secondary data in this study primarily focuses on demographic statistics of the study population using census data, maps, photographs and Geographic Information Systems data. Basic demographic data for the study location and or population was collected from the website city-data.com (www.city-data.com, 2016). This web based software displays data that can be broken down neighborhood by neighborhood, and primarily uses data collected in 2010 by the U.S. Census Bureau.

One of the methods used to objectively measure features of the built environment, including The Overton Park System, that may influence physical activity is a software tool named Geographic Information Systems (GIS). GIS data provides an opportunity for researchers to construct measures of environmental and built environment attributes and to use these measures to develop indices for physical activity for cities, regions or local communities (Leslie et al., 2005). Several environmental variables associated with outdoor physical activity can be measured and categorized using GIS.

3.4 Data Analysis

The data findings derived from the three research methods were analyzed using quantitative methods as well as qualitative data. Data Analysis primarily uses descriptive statistics and frequencies and attempts at data triangulation and statistical analysis are also used as supplemental analysis. Data triangulation is used to indicate that more than two methods are used in a study with a view to double or triple check results. In this study, data from the online survey are compared against data from previous studies in the literature review, in order to cross-check the results and themes. Researchers can be more confident with a result if different methods lead to the same result. By using three methods to get the answer to one question, the hope is that two of the three methods may produce similar answers; if three clashing answers are produced, the investigator knows that the question needs to be reframed, methods reconsidered, or both. Triangulation is a powerful technique that facilitates the researcher in validating data through cross-verification from more than two sources (Cohen and Manion, 1986; Demming and Swaffield, 2011). After data from individual questions are reviewed, statistical analysis using multiple regression tests is used to find answers to the research questions of the study.

3.5 Bias and Error

This research study may have several facets that could contribute to or be considered a bias or limitation. One possible limitation of this study is the fact that the survey was developed by the researcher for the purposes of this study alone and has not been validated as a measurement tool before. The survey was developed based on the literature review and the research questions, but no statistical measures were run to determine internal construct validity (Deming and Swaffield, 2011). Another possible limitation is that the study population is a product of convenient sampling and is not randomized. Countless factors contribute to health, but this study primarily uses physical activity to assess health, which could be considered a limitation. Incorporation of additional factors to health was beyond the scope of this study. Hypotheses of outcomes could impact this study and may also be viewed as a limitation. The study population may have inherent bias towards the neighborhood and park system within. These inherent bias may influence survey data results. Secondary data as well as statistical analysis methods may also be prone to errors.

3.6 Summary

This study uses quantitative research methods to quantify the health impacts of parks and trail systems specifically for the Overton Park System in

Fort Worth, Texas. The study also uses qualitative data to add depth and richness to the data. The procedure of the study includes data collection, data analysis and statistical analysis. Data collection was primarily done through an online survey of the study location as well as passive observations. A systematic literature review and secondary data sources are used as supplemental information to help derive a standard set of indicators and frequencies that impact health of residents near parks and trail systems. A concise matrix of micro-scale environmental variables derived from literature review was used as a base for the passive observation and the online survey while the matrix of macro-scale environmental variables was used as a base for GIS analysis. This approach applies to The Overton Park System in Fort Worth, Texas. Chapter 4 discusses the analysis and findings from the research methods application upon The Overton Park System.

Chapter 4 Analysis and Findings

4.1 Introduction

This chapter reviews and analyzes the findings of this research study. The survey was initially sent to the representatives of the four neighborhood associations that border the Overton Park Trail System. The neighborhood associations sent the survey out to members of their associations and posted the link to the survey on their community websites. After two weeks, another email blast was sent out as a reminder, requesting participation. The survey remained open for four weeks starting Monday March 1 and ending Monday April 4, 2016. After the close of the survey, results were analyzed through statistical measures. Descriptive statistics and frequencies were used as the primary tool for analyzing the data of the survey. Passive observations, which consisted of site visits and photography of features and amenities, were also used for analysis. Secondary data using census and GIS data for mapping purposes was used as supplementary data. Data triangulation was also used as an attempt to confirm findings of the study. The Following section first covers the results of the survey, then incorporates other sources of data such as passive observations, secondary data, and statistical analysis.

4.2 Survey Findings

4.2.1 Survey Respondents Demographic Profile

A total of 226 surveys were started, with 188 completed. The first section of the survey includes questions which asked for demographic information including gender, age, height and weight. Of the respondents 36% were male and 64% were female. The average age of respondents was 56 years with a median age of 57 years. Body mass index (BMI) was calculated using the respondents' height and weight. No respondents were underweight.

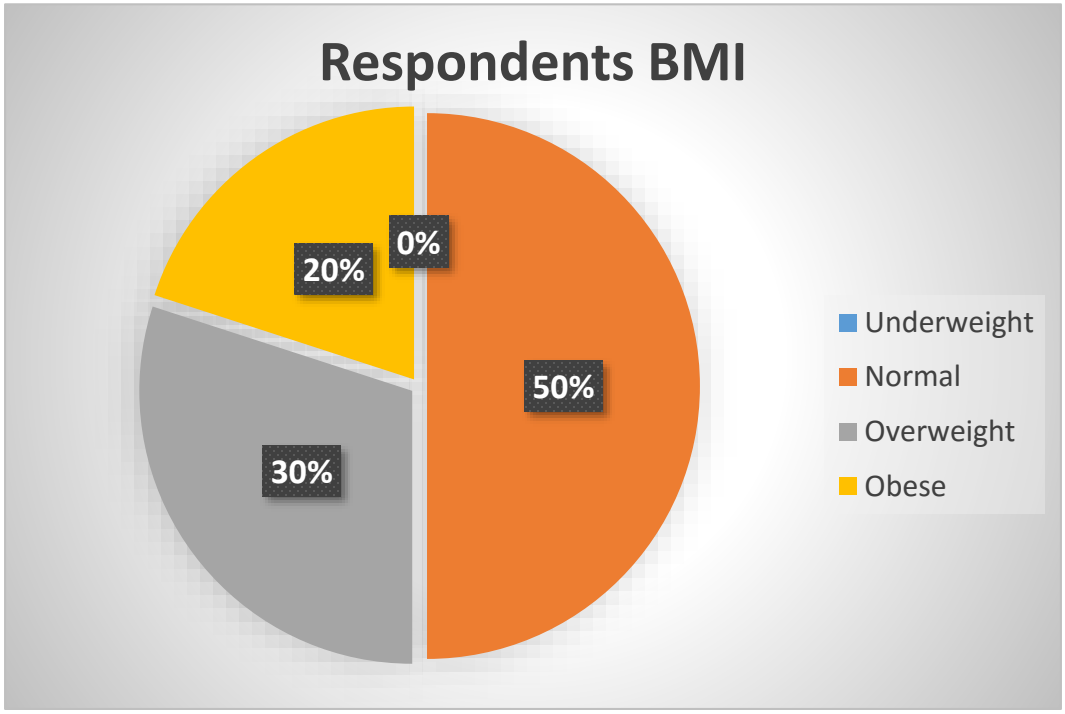

Figure 4-1 Respondents Body Mass Index.

Fifty percent of respondents had a BMI between 18.5 and 24.9, indicating a normal weight. Thirty percent of respondents had a BMI between 25 and 29.9, indicating they were overweight. Twenty percent of respondents had a BMI of greater than 30, indicating obesity. See Figure 4-1. As of 2014, 31.9% of all adults in the state of Texas were obese, ranking the state as the 11th most obese state in the U.S. (The State of Obesity, 2016). Over two thirds of all adults in the U.S. are considered to be overweight or obese (U.S. Department of Health and Human Services, 2012). The adults in this study have a less frequent incidence of overweight and obesity as compared to the typical adult in the state of Texas and the overall U.S.

The last question in the demographic section of the survey asked if respondents had any disabilities that would prevent them from participating in light, moderate or vigorous intensity physical activity. Of the 188 respondents, 13 had disabilities that would prevent them from participating in light intensity physical activity, while 35 reported disabilities preventing moderate intensity physical activity, and 37 reported disabilities preventing vigorous intensity physical activity. The researcher decided that the 13 respondents that had disabilities that prevented light physical activity would be removed from further data regarding physical activity, as these respondents may skew the data. Those respondents with disabilities that were still able to participate in at least light

activity were left as part of the sample, as they would still be able to accurately answer the survey questions that related to activity participation as a whole.

4.2.2 Proximity and Accessibility Questions

The next section of the survey contained questions related to residential proximity and accessibility to The Overton Park System. Question 1 asked which park(s) respondents primarily used: 83% of respondents reported using Overton Park, 37% reported using Foster Park, and 50% reported using the trail section that connects to the Trinity Trail System along the Trinity River.

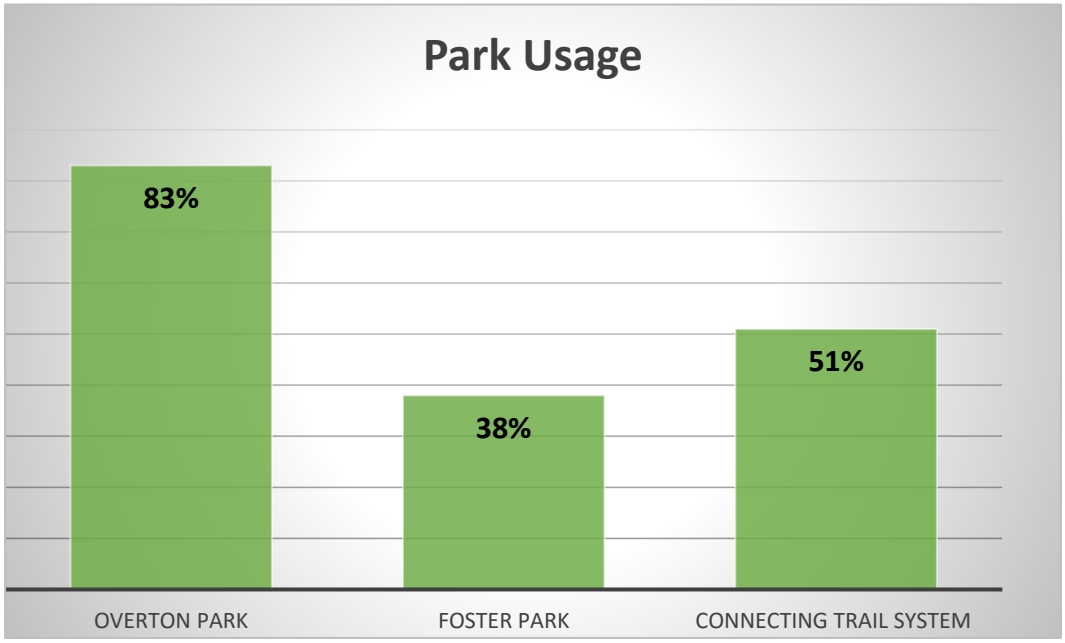

Figure 4-2 Park Primarily Used

Figure 4-2 illustrates the percentage of respondents that primarily use the three major park sections that make up The Overton Park System.

The next question, number 2, asked how long it would take to walk from the respondent's house to the Overton Park System, 47% reported a 1-5 minute walk, 30% reported a 6-10 minute walk, 13% reported an 11-15 minute walk, 8% reported a 15-25 minute walk, and 2% reported a walk longer than 25 minutes. Figure 4-3 illustrates respondents walking distance to park system.

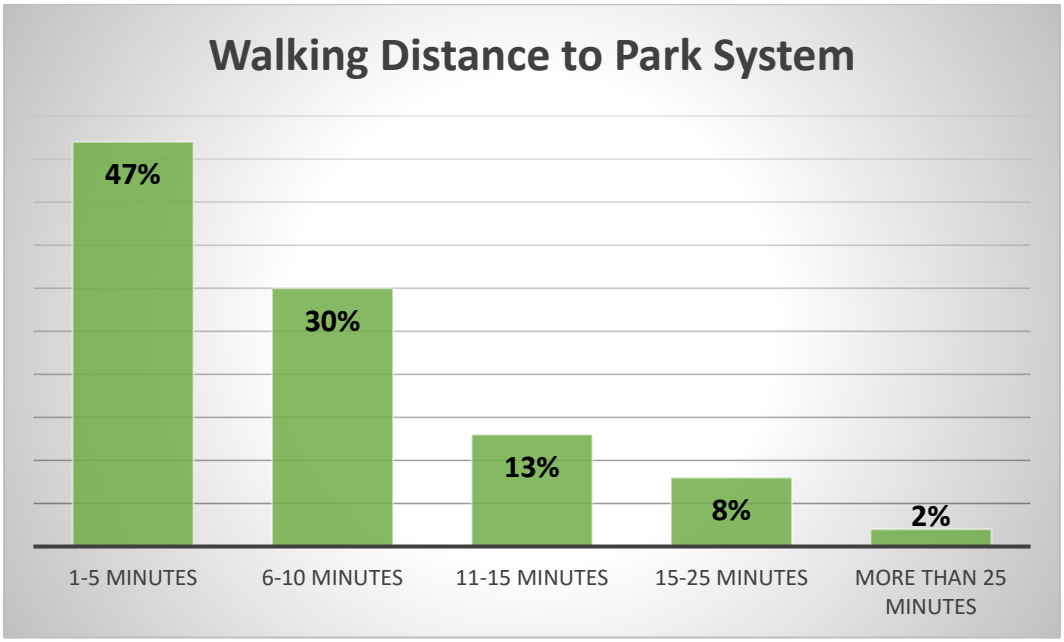

Figure 4-3 Walking Distance to Park System

Questions 3 and 4 asked about specific locations of residences for mapping and network analysis purposes. Respondents were given the option to enter their address, and these addresses were used to map respondent's proximity to the park system. GIS was used to create a map showing Euclidean distance

from the park and each respondent that voluntarily entered their address was marked on this map. Results show that 40 respondents live within ¼ mile, 30 respondents live between ¼ mile and ½ mile, 14 respondents live between ½ and 1 mile, and 14 respondents live further than 1 mile from the closest part of The Overton Park System. Figure 4-4 illustrates respondents' approximate proximity to The Overton Park System.

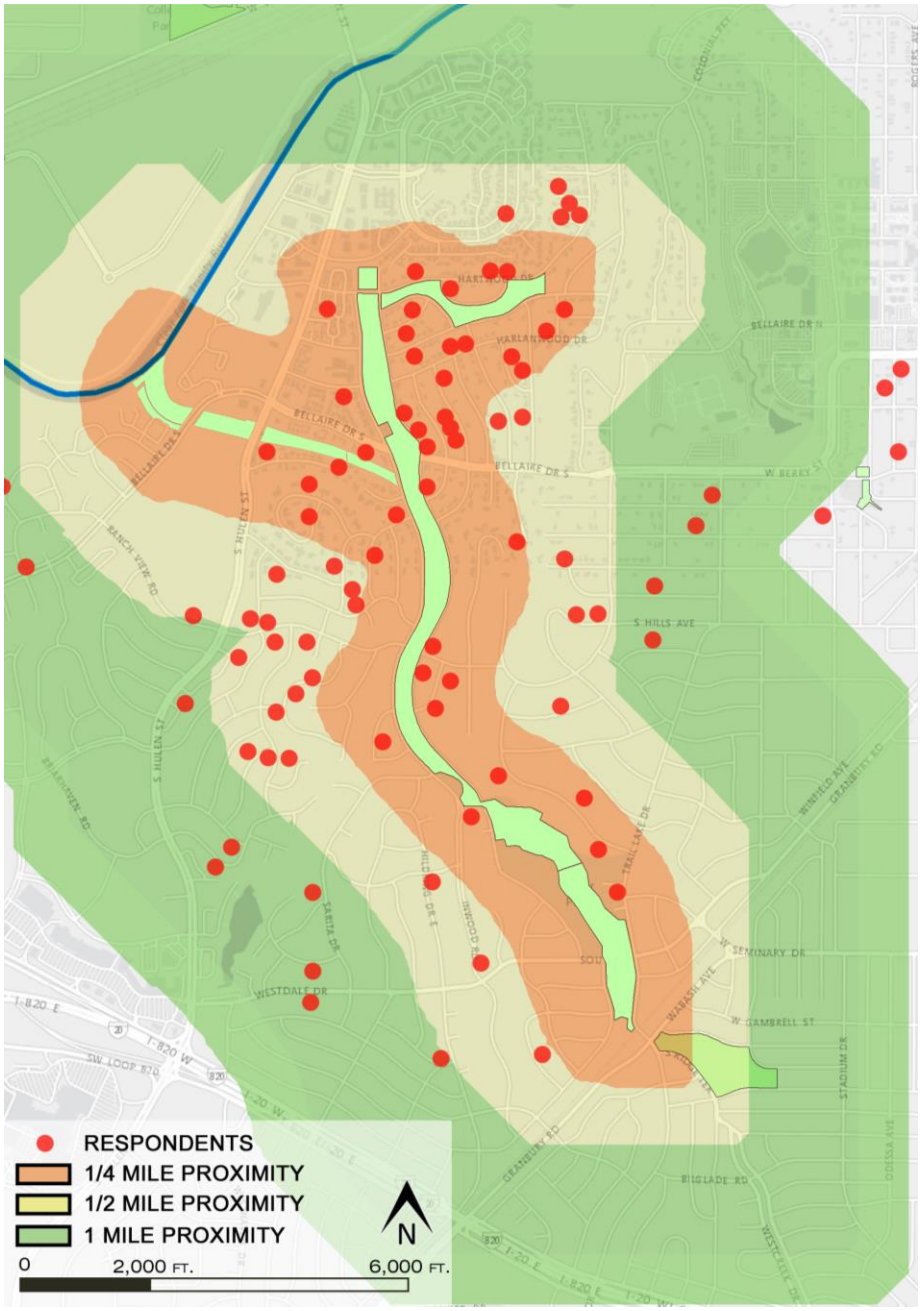

Figure 4-4 Respondents Proximity to Park System - source (Batchgeo 2016)

The last two questions in the proximity and accessibility section focused on perception of accessibility and park usage frequencies. Question 5 was a

Likert scale question asking respondent to rate how accessible The Overton Park System is via walking or jogging, bicycle, car, and rollerblading or skateboarding. Figure 4-5 illustrates the results of the question asking respondents how accessible they feel The Overton Park System is from their house. In response to walking and jogging accessibility for The Overton Park System; 80% perceived it to be very accessible, 16% perceived it to be somewhat accessible, and 4% perceived it as not very accessible. In response to bicycle accessibility of The Overton Park System; 83% perceived it to be very accessible, 13% perceived it to be somewhat accessible, and 4% perceived it as not very accessible. In response to accessibility by car of The Overton Park System; 97% perceived it to be very accessible, 3% perceived it to be somewhat accessible, and 0% perceived it as not very accessible. In response to rollerblade or skateboard accessibility of The Overton Park System; 58% perceived it to be very accessible, 23% perceived it to be somewhat accessible, and 19% perceived it as not very accessible.

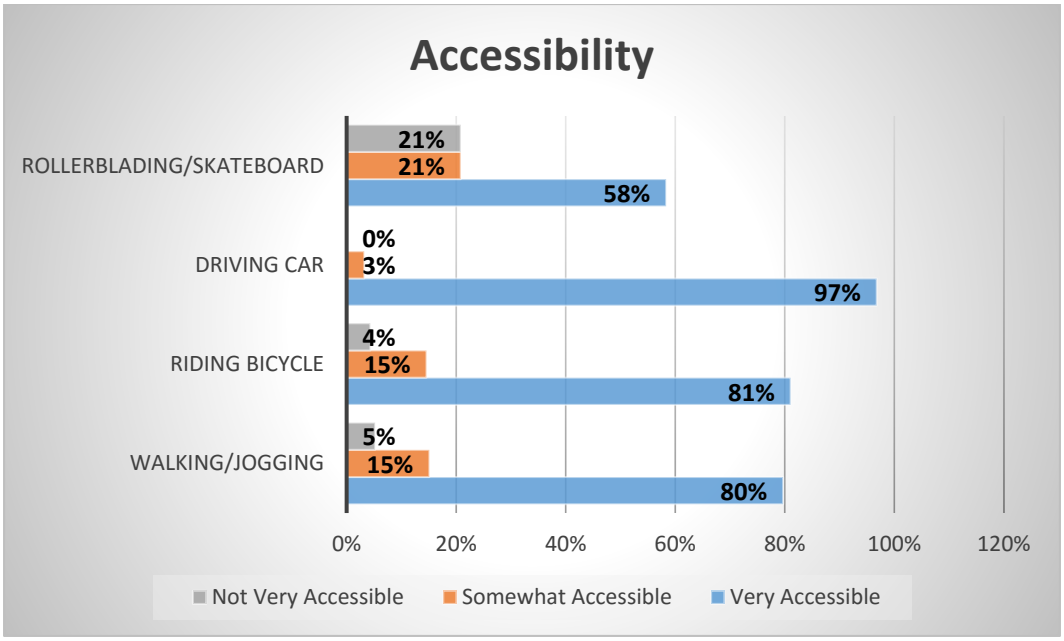

Figure 4-5 Perception of Accessibility

Question 6 in the proximity and accessibility section of the survey asked respondents to indicate how they typically get from their residence to the parks system. Walking received the highest number of responses at 68%, followed by car at 34%, bicycle at 26%, running or jogging at 23%, and 0% for rollerblading

or skateboarding.

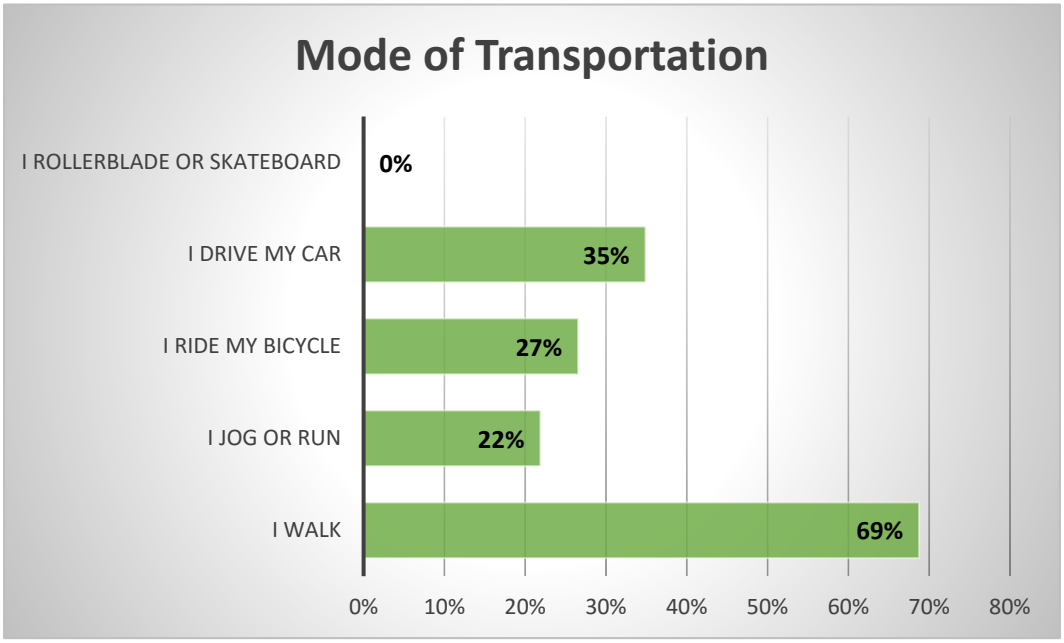

Figure 4-6 Typical Mode of Transportation

4.2.3 Park Usage and Physical Activity Questions

The questions in the next section of the survey were designed to collect data related to park usage and physical activity levels of respondents. The first question in this section was survey question number 7, which asked how many times respondents visit The Overton Park System in a typical month, see Figure 4-7 for illustrated results. Responses to this question showed that 3% of respondents visited The Overton Park System less than one time per month, 27% visited 1-5 times per month, 22% visited 6-10 times per month, 17% visited 11-15 times per month, 12% visited 16-20 times per month, and 19% visited hmore than

20 times per month.

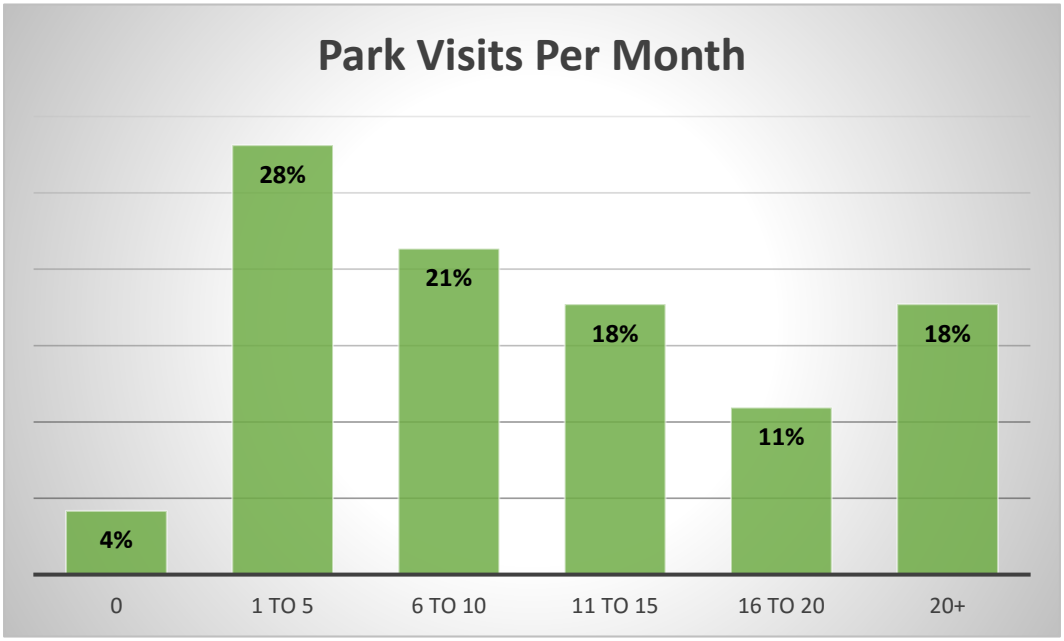

Figure 4-7 Park Visits Per Month

Question 8 asked how much time respondents spend in the park on an average visit. Respondents spend an average of 59 minutes in the park on an average visit. Question 9 asks respondents how much of their total time in the park is spent being physically active. Respondents reported an average of 41 minutes of physical activity when they visited the park.

Questions 10-12 were multilevel and relate to physical activity levels of respondents, specifically focusing on frequency, duration, and percentage of physical activity completed in The Overton Park System. Question 10 asked how many days per week respondents participate in light intensity physical activity for

at least 10 minutes at a time. See Figure 4-8 for illustrated results.

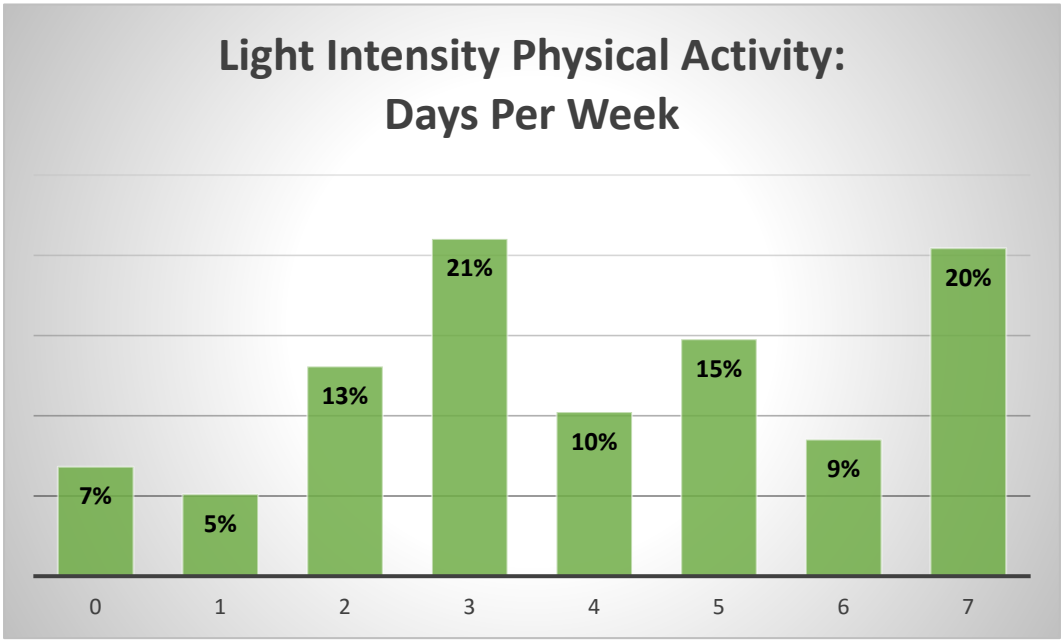

Figure 4-8 Light Intensity Physical Activity Per Week

The most frequent response to this question showed that 21% of respondents reported light intensity physical activity 7 days per week. Other responses indicated that 20% reported 3 days of light intensity physical activity per week, 15% reported 5 days per week, 14% reported 2 days per week, 10% reported 4 days per week, 8% reported 6 days per week, 6% reported 1 day per week, while 7% of respondents reported less than 1 day per week. The second part of question 10, 10a, asked respondents to report the total time of light intensity physical activity per day, on days when these activities are performed. Respondent spend an average of 89 minutes performing light activity. The last piece of question 10, 10b, asked respondents to report the percentage of their weekly light intensity

physical activity that is done in The Overton Park System. See Figure 4-9.

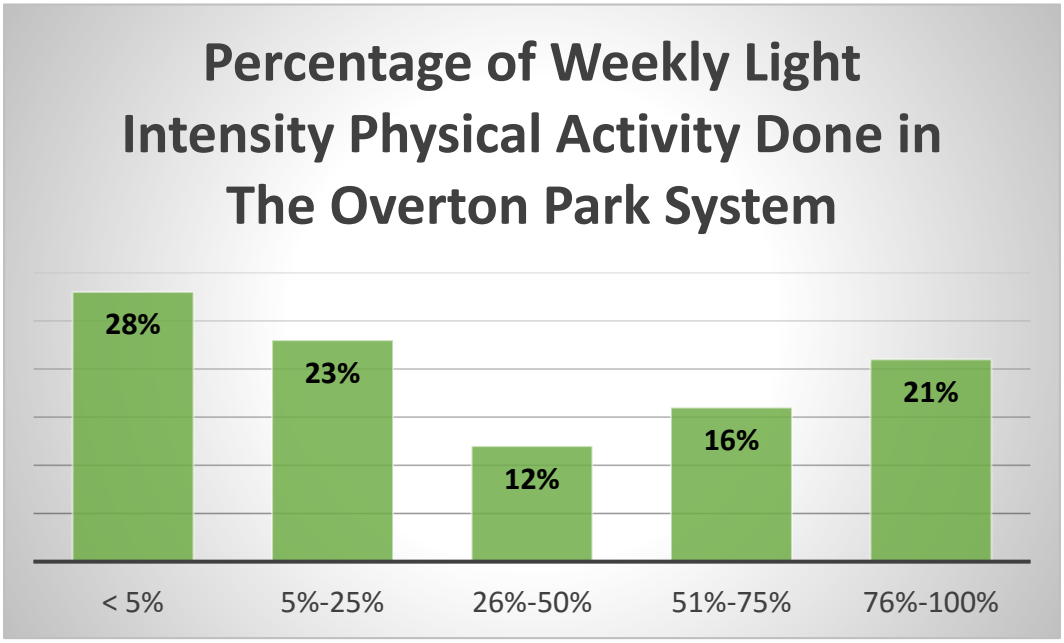

Figure 4-9 Light Intensity Physical Activity Done in Park System

Responses to this question were as follows: 30% reported less than 5% of total weekly light intensity physical activity done in The Overton Park System, 22% of respondents reported 5%-25%, 10% of respondents reported 26%-50%, 17% of respondents reported 51%-75%, and 22% of respondents reported 76%-100%.

Question 11 was similar to question 10, only this question focused on moderate intensity physical activity as opposed to light intensity, and asked how many days per week respondents participate in moderate intensity physical

activity for at least 10 minutes at a time. See Figure 4-10 for illustrated results.

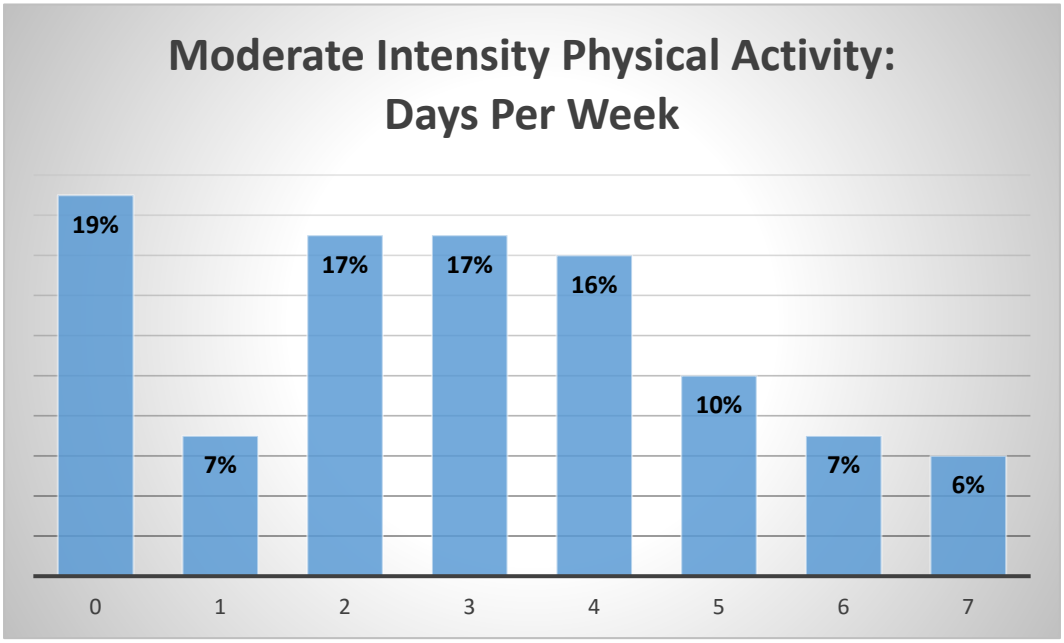

Figure 4-10 Moderate Intensity Physical Activity Per Week

The most frequent response to this question showed that 18% of respondents reported moderate intensity physical activity 2 days per week. Other responses indicated that 17% reported 3 days of moderate intensity physical activity per week, 16% reported 4 days per week, 11% reported 5 days per week, 8% reported 1 day per week, 6% reported 6 days per week, 6% reported 1 day per week, while 17% of respondents reported less than 1 day per week. The second part of question 11, 11a, asked respondents to report the total time of moderate intensity physical activity per day, on days when these activities are performed. Respondents averaged 51 minutes of moderate physical activity. The last piece of question 11, 11b, asked respondents to report the percentage of their weekly

moderate intensity physical activity that is done in The Overton Park System. See Figure 4-11 for illustrated results.

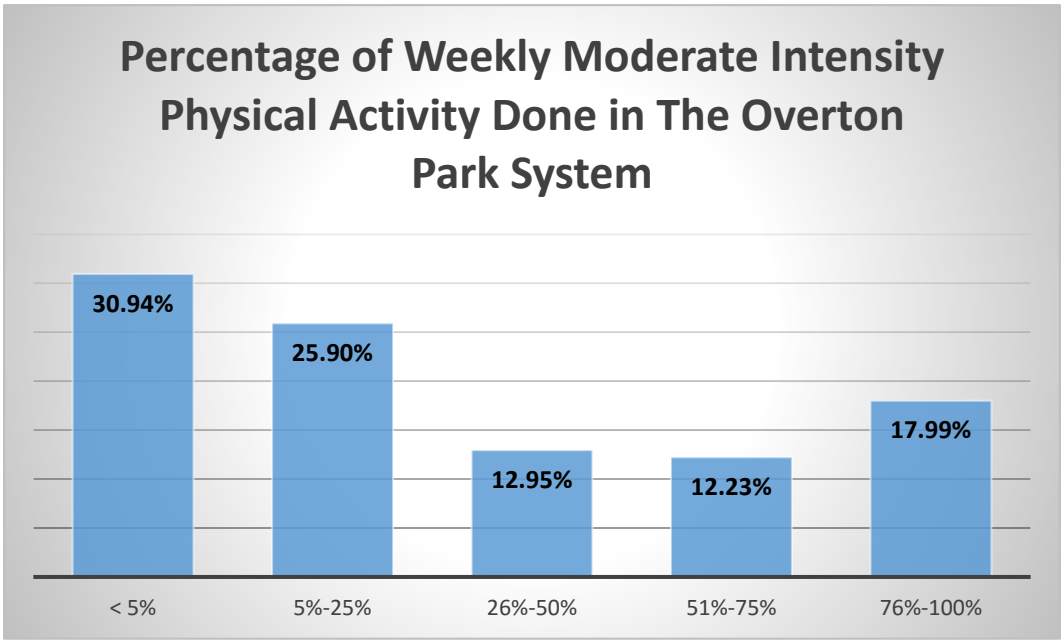

Figure 4-11 Moderate Intensity Physical Activity Done in Park System

Responses to this question were as follows: 31% reported less than 5% of total weekly moderate intensity physical activity done in The Overton Park System, 24% of respondents reported 5%-25%, 13% of respondents reported 26%-50%, 13% of respondents reported 51%-75%, and 18% of respondents reported 76%-100%.

Question 12 asked the same questions for vigorous intensity physical activity. See Figure 4-12 for illustrated results. For vigorous intensity physical activity 39% of respondents reported that they never participate in vigorous intensity physical activity, while 11% reported doing vigorous activity once a

week, 10% twice a week, 15% 3 times a week, 10% 4 days per week, 10% 5 days per week, 2% 6 days per week, and 5% reported vigorous activity daily.

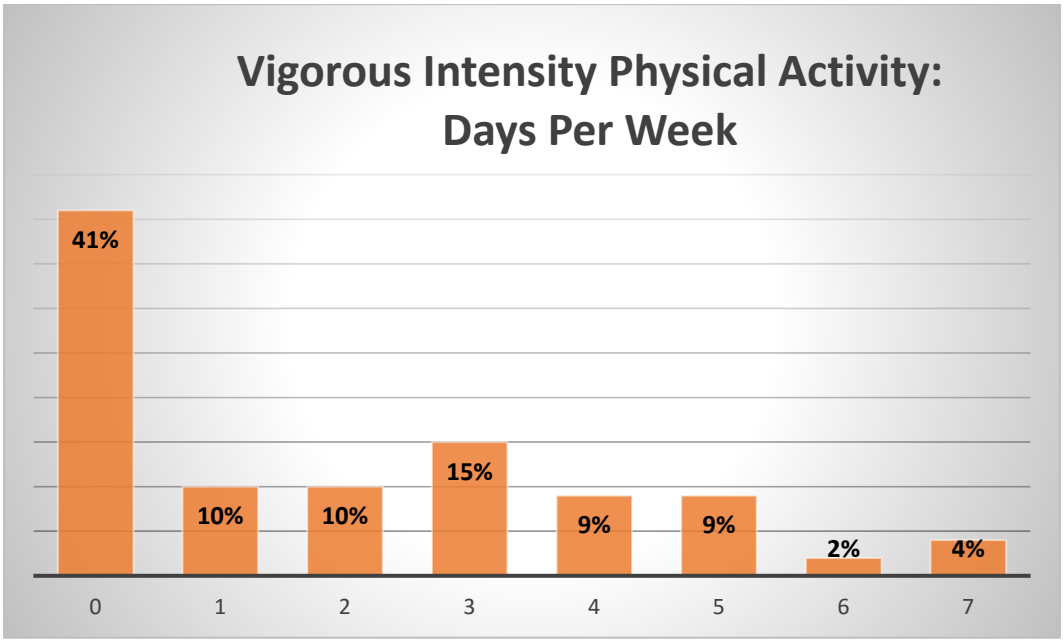

Figure 4-12 Vigorous Intensity Physical Activity Per Week

Respondents reported an average of 55 minutes of vigorous physical activity on days when they performed vigorous physical activity. Of that physical activity 45% reported less than 5% of total weekly moderate intensity physical activity done in The Overton Park System, 21% of respondents reported 5%-25%, 14% of respondents reported 26%-50%, 7% of respondents reported 51%-75%, and 13% of respondents reported 76%-100%. Figure 4-13 illustrates these results.

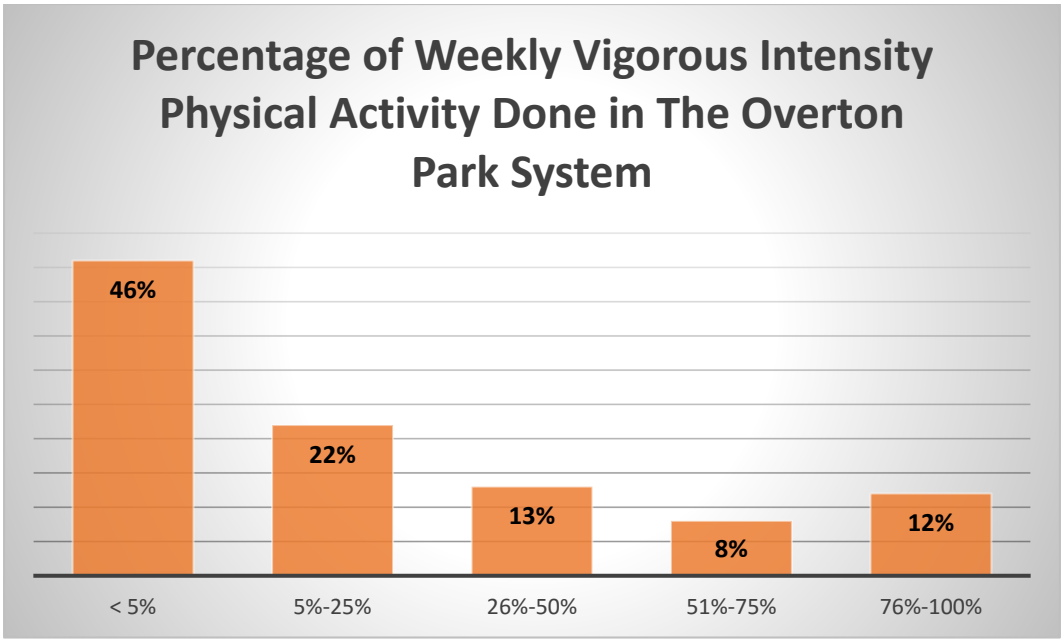

Figure 4-13 Vigorous Intensity Physical Activity Done in Park System

The next question in the park usage and physical activity level section of the survey was question 12, which asked what activities respondents participate in during their average visits to The Overton Park System. See Figure 4-14 for illustrated results. Walking was the most popular activity with 87% of respondents reporting participation. Bicycling was the second most popular activity with 38% reporting participation, followed closely by jogging at 36%, wildlife viewing at 30%, and playing with kids at 26%. The rest of the listed options included watching kids at playground at 17%, tennis at 13%, reading and relaxing at 13%, picnicking at 7%, rollerblading or skateboarding at 0%, and 13%

chose the other(s) option. Responses that were not listed on the

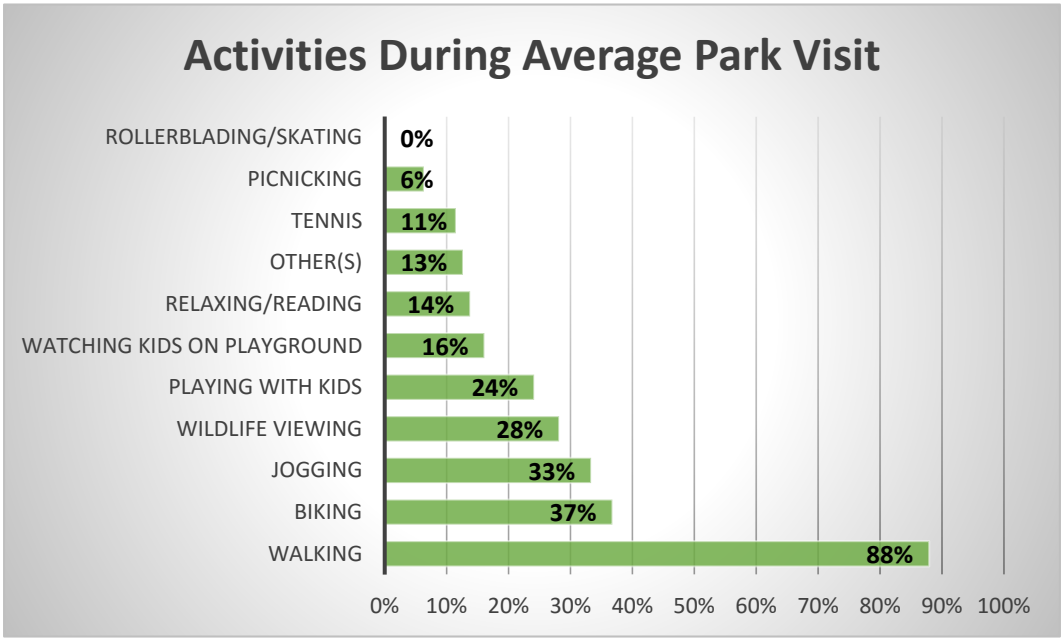

Figure 4-14 Activities During Average Park Visit

survey but written in by respondents included: walking dog at 11%, talking or socializing 2%, throwing rocks, boot camp class, and picking up trash.

Question 14 asked respondents which option best describes their activity level on a normal visit to The Overton Park System. See Figure 4-15 for illustrated results. Responses to this question indicated that mostly moderate physical activity (walking or biking at a moderate pace) was the most popular activity level with 55% of respondents choosing this option. Mostly light physical activity (walking or strolling at a slow pace) received the second most responses at 29%. Mostly vigorous physical activity (vigorous jogging, running, or biking) received 15% of the responses. The option that received the fewest

responses was mostly

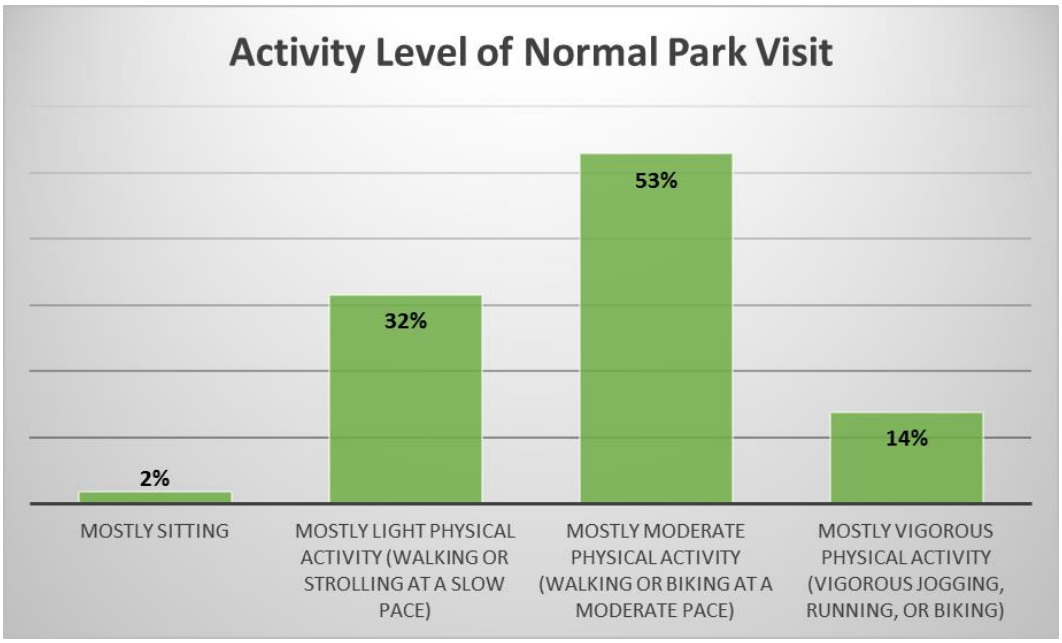

Figure 4-15 Activity Level During Average Park Visit

sitting and it was chosen by 1% of respondents. The last question in the park usage and physical activity section of the survey was question 15 which asked respondents to indicate who accompanies them on their park visits (check all that apply). Illustrated results for question 15 can be seen in Figure 4-16. Responses to this question indicated that family was the most popular choice with 62% of respondents choosing this option. The other options listed in this question included: going alone at 54%, with pets 38%, with friends 27%, with members of an organized group 3%, and with other(s) at 1%. The respondents that chose others wrote in husband and grandson which should be included in the family option. If

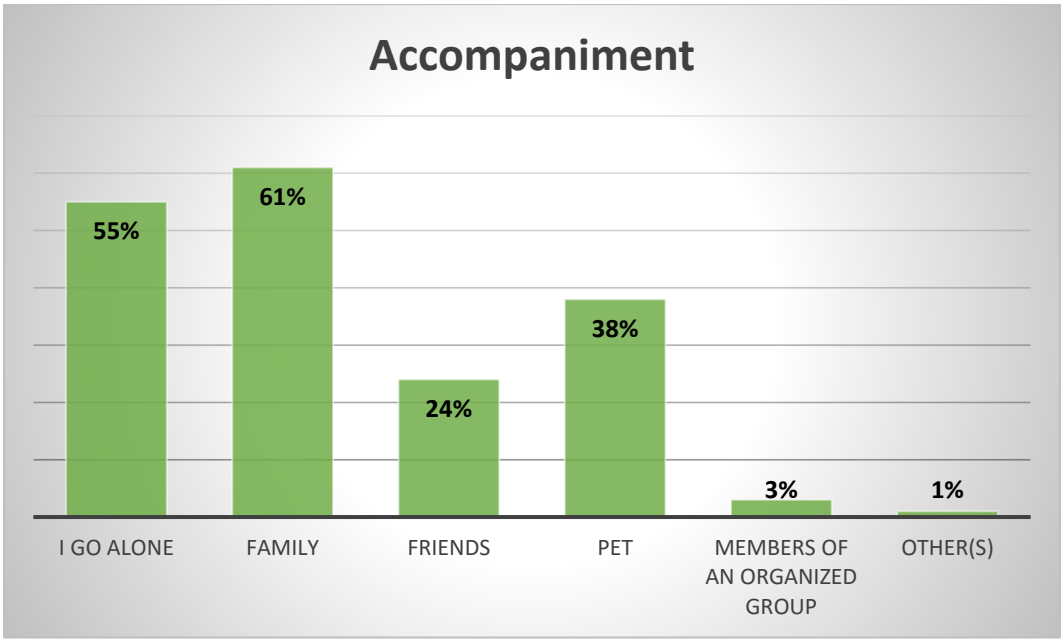

Figure 4-16 Accompaniment During Parks Visits

these responses are added to family it increases the percentage of responses to 63%.

4.2.4 Features and Amenities Questions

The next section of the survey included three questions that relate to features and amenities of The Overton Park System and how they impact respondent's physical activity. Question 16 asked respondents to indicate areas of the park system that they use during visits. See Figure 4-17 for illustrated results. The trail system was shown to be the most popular feature of the park with 94% of respondents selecting this option. Green and open space was indicated to be

used by 41% of respondents.

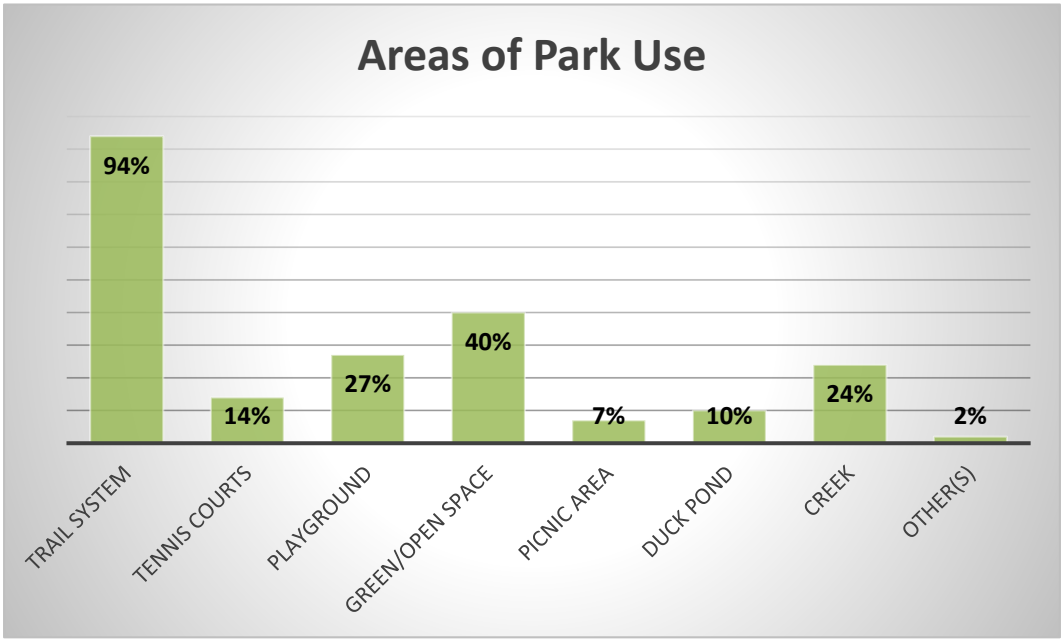

Figure 4-17 Areas of Park Used During Average Visit

Playground areas were shown to be used by 28% of respondents and the creek received responses from 25%. The other areas of use that were listed as options included: the tennis courts which received responses by 14% of respondents, the duck pond at 10%, picnic areas 6%, and the other(s) option received 3% response rate. Written responses by people who chose the other option included water fountains, benches, and one respondent wrote “I don’t use the creek, but I appreciate and enjoy the wildlife it brings”.

Question 17 was a Likert scale question that asked respondents to rate how important or unimportant certain features and amenities are when thinking about being physically active in The Overton Park System. Options that received

responses of very important or important were added together to indicate features that respondents felt were important in impacting physical activity. Features and amenities that received an 80% response rate or more were categorized as very important. Illustrated results can be seen in Figure 4-18. The results of this process indicated that the following features and amenities were viewed as very important to respondents: maintenance of park areas was selected by 95% of respondents, cleanliness at 95%, easy access 94%, shade trees and greenery 94%, trail surface 90%, green and open space 89%, trash cans 88%, proximity to house 83%, peacefulness and quiet 82%. Features and amenities that received a response rate of 50%-79% were categorized as important to respondents. The following features and amenities were categorized as important: lighting received a 69% response rate, drinking fountains 59%, playground areas 59%, seating 55%, and being near the creek also received 55%. Features and amenities that received a response rate lower than 50% were categorized as less important. The following features and amenities were categorized as less important: restrooms received a 43% response rate, picnic areas 39%, parking 37%, sports fields and courts 36%, bike racks 34%, and outdoor fitness equipment received the lowest response rate at 24%. Figure 4-2 illustrates results from question 17 showing the features and amenities listed from highest to lowest level of importance in contributing to physical activity, according to the survey the respondents.

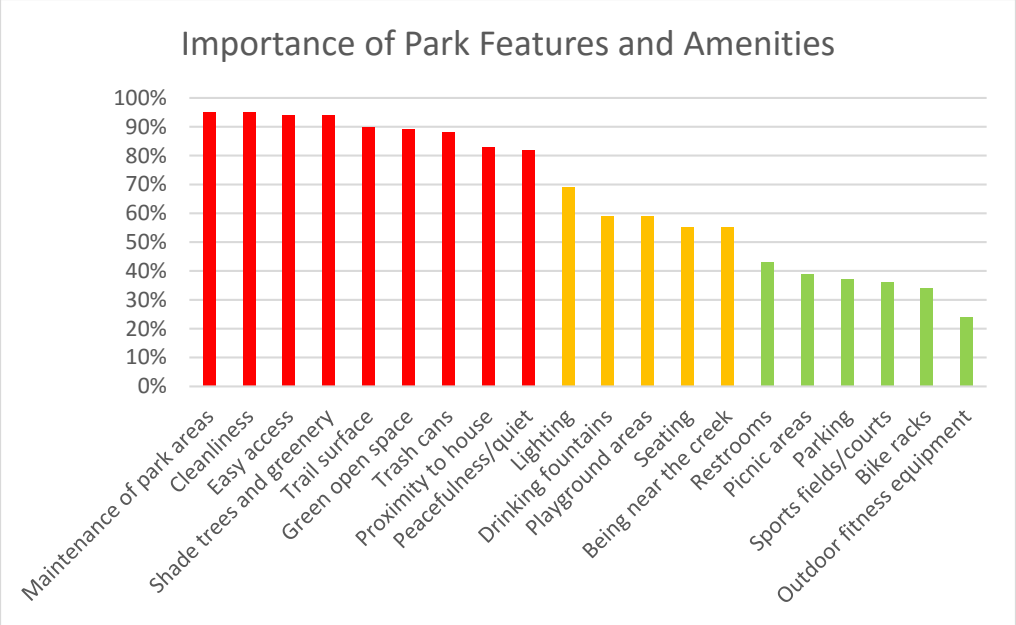

Figure 4-18 Importance of Park Features and Amenities

Question 18 asked respondents to list other features or amenities that are important when thinking about physical activity in The Overton Park System but were not listed in question 17. Six responses listed the need for sidewalk connections from neighborhoods to the park trail system. Four respondents listed pet waste disposal bags and receptacles as features that are important. Three responses listed wildlife as a feature of the park system that is important to them. Two respondents listed safety as a feature of concern. Two respondents listed decorative planting as a feature that is important to them when thinking about being physically active in The Overton Park System

4.2.5 Perception of Park Space Questions

The last section of the survey contained questions that relate to user perception of The Overton Park System. Question 19 was a Likert scale question that asked respondents to indicate how much they agree or disagree with six listed statements about the park system. Illustrated results for each statement of question 19 can be seen in figure 4-19. The first statement of the question says "Overton Park is Clean". Responses to this statement were as follows: 48% strongly agree, 44% Somewhat agree, 2% neither agree or disagree, 2% somewhat disagree, and 4% strongly disagree. The second statement of the question said "Overton Park has features and amenities that I am interested in". Responses to this statement were as follows: 58% strongly agree, 35% Somewhat agree, 5% neither agree or disagree, 0% somewhat disagree, and 2% strongly disagree. The third statement of the questions said "Overton Park is attractive". Responses to this statement were as follows: 65% strongly agree, 31% Somewhat agree, 2% neither agree or disagree, 0% somewhat disagree, and 2% strongly disagree. The fourth statement of the question said "Overton Park is safe". Responses to this statement were as follows: 52% strongly agree, 37% Somewhat agree, 8% neither agree or disagree, 1% somewhat disagree, and 2% strongly disagree. The fifth statement of the question said "Overton Park is well maintained". Responses to this statement were as follows: 38% strongly agree, 50% Somewhat agree, 8% neither agree or disagree, 2% somewhat disagree, and 2% strongly disagree. The

last statement of this question said “Overton Park offers a health benefit to people of the neighborhood”. Responses to this statement were as follows: 86% strongly agree, 11% Somewhat agree, 1% neither agree or disagree, 0% somewhat disagree, and 0% strongly disagree.

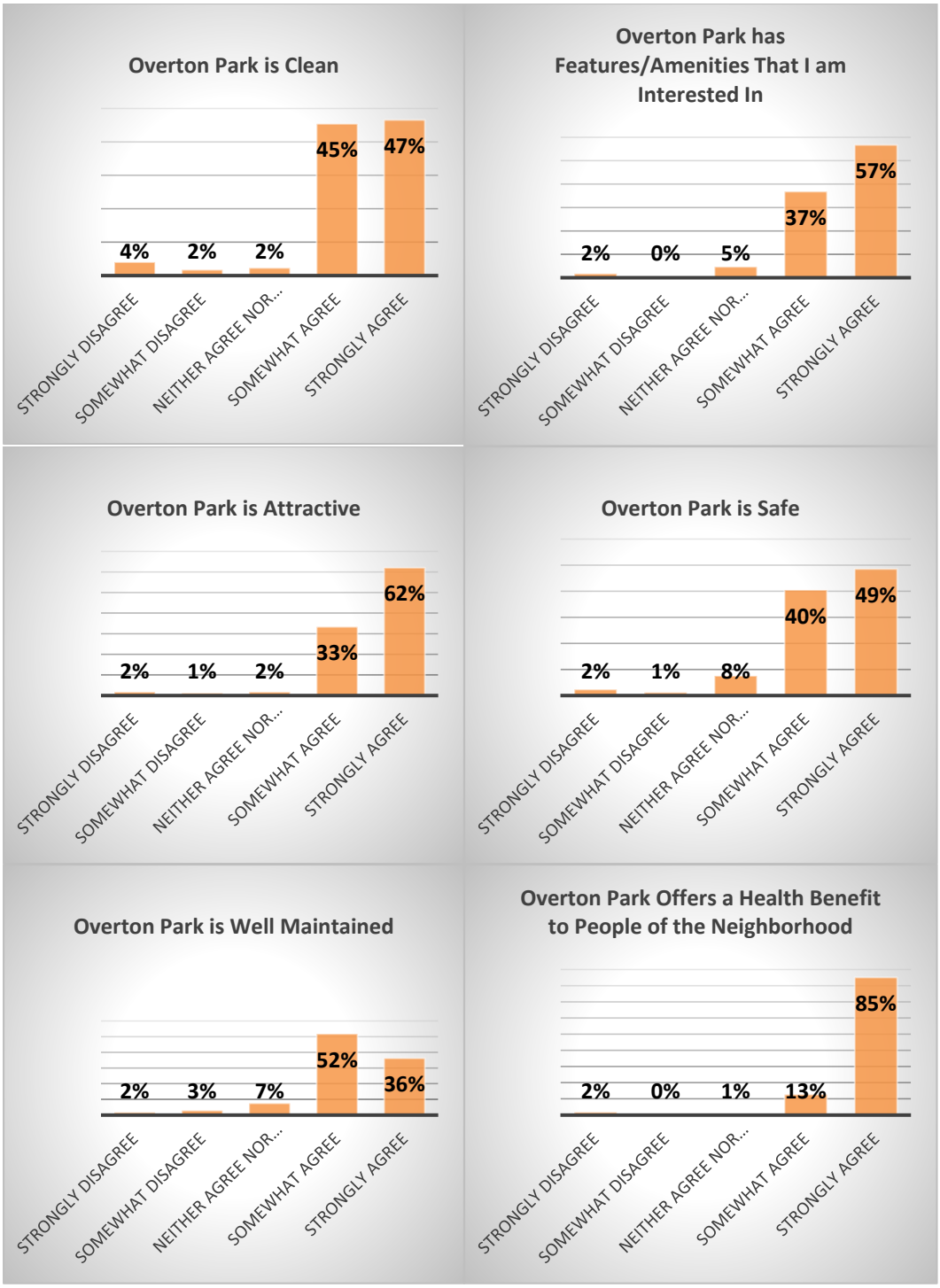

Figure 4-19 Perceptions of The Overton Park System

The next question in the perception of park space section is question 20. This was another Likert scale question that asked respondents to indicate to what extent a list of concerns or problems keeps them from participating in physical activity in Overton Park, see Figure 4-20 for illustrated results. The first problem or concern that was listed in question 20 was “Fear of crime in the park”. Responses to this question were as follows: 65% believed it was not a problem, 22% believed it was a minor problem, 11% believed it was a moderate problem, and 2% believed it was a major problem. The next problem or concern that was listed in question 20 was “Lack of scenic beauty”. Responses to this question were as follows: 84% believed it was not a problem, 10% believed it was a minor problem, 5% believed it was a moderate problem, and 1% believed it was a major problem.

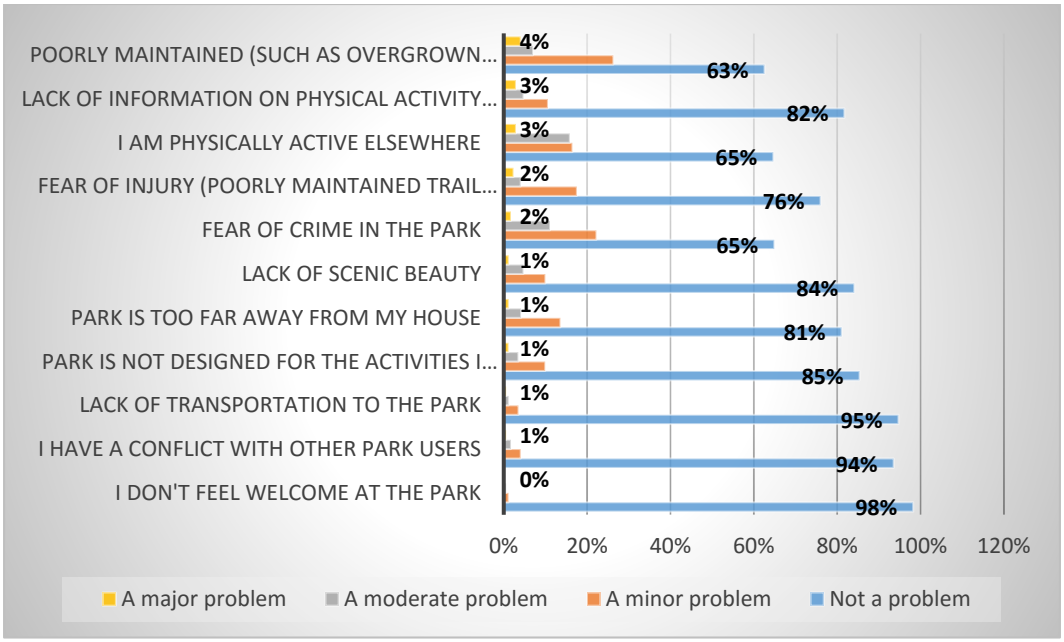

Figure 4-20 Perceptions of Problems or Concerns

The next problem or concern that was listed in question 20 was "Poorly maintained (such as overgrown plants or excessive trash)". Responses to this question were as follows: 63% believed it was not a problem, 26% believed it was a minor problem, 7% believed it was a moderate problem, and 4% believed it was a major problem. problem, 5% believed it was a moderate problem, and 1% believed it was a major problem. The next problem or concern that was listed in question 20 was "Park is not designed for the activities I want to do". Responses to this question were as follows: 85% believed it was not a problem, 10% believed it was a minor problem, 4% believed it was a moderate problem, and 1% believed it was a major problem. problem, 5% believed it was a moderate problem, and 1% believed it was a major problem. The next problem or concern

that was listed in question 20 was “Fear of injury (poorly maintained trails and benches)”. Responses to this question were as follows: 76% believed it was not a problem, 18% believed it was a minor problem, 4% believed it was a moderate problem, and 2% believed it was a major problem. problem, 5% believed it was a moderate problem, and 1% believed it was a major problem. The next problem or concern that was listed in question 20 was “Park is too far away from my house”. Responses to this question were as follows: 81% believed it was not a problem, 14% believed it was a minor problem, 4% believed it was a moderate problem, and 1% believed it was a major problem. problem, 5% believed it was a moderate problem, and 1% believed it was a major problem. The next problem or concern that was listed in question 20 was “I am physically active elsewhere”. Responses to this question were as follows: 65% believed it was not a problem, 16% believed it was a minor problem, 16% believed it was a moderate problem, and 3% believed it was a major problem. problem, 5% believed it was a moderate problem, and 1% believed it was a major problem. The next problem or concern that was listed in question 20 was “Lack of information on physical activity opportunities at the park”. Responses to this question were as follows: 82% believed it was not a problem, 10% believed it was a minor problem, 5% believed it was a moderate problem, and 3% believed it was a major problem. problem, 5% believed it was a moderate problem, and 1% believed it was a major problem. The next problem or concern that was listed in question 20 was “Lack of

transportation to the park". Responses to this question were as follows: 95% believed it was not a problem, 3% believed it was a minor problem, 1% believed it was a moderate problem, and 1% believed it was a major problem. The next problem or concern that was listed in question 20 was "I don't feel welcome at the park". Responses to this question were as follows: 98% believed it was not a problem, 1% believed it was a minor problem, 1% believed it was a moderate problem, and 0% believed it was a major problem. The next problem or concern that was listed in question 20 was "I have a conflict with other park users". Responses to this question were as follows: 93% believed it was not a problem, 4% believed it was a minor problem, 2% believed it was a moderate problem, and 1% believed it was a major problem.

In addition to the options listed in question 20, respondents had the opportunity to write-in their concerns. The researcher analyzed this data for reoccurring themes. The most frequently cited concerns included lack of sidewalks, narrow trails, and safety in accessing the park. Respondents mentioned that on narrow portions of the trail, bicycles would "run people off of the road" or "whiz by without announcing they were coming." Other concerns that were listed at least once, but were not frequently repeated included: dogs that were off of a leash, fear of having vehicles broken into, a lack of bathrooms on the trails and in the parks, a shortage of water fountains, areas of overcrowding,

suspicious people in the park, and dog waste not being cleaned up. A complete list of quoted comments can be seen in Appendix B.

4.3 Summary Findings

This section discusses and reviews findings for each section of the survey of the research study within the context of overall findings. Where it is applicable this section also refers to findings from passive observations, secondary data and archival data review.

Starting with the demographic section, the findings revealed that the average age of the study population according to city-data.com is 38 years (City-Data, 2016). However, the average age of respondents to the survey was 56 years. This discrepancy is likely due to the survey only allowing respondents over the age of 18. It is interesting to note that no respondents were considered underweight according to the body mass index calculations. Body Mass Index data was collected for the city of Fort Worth from www.governing.com, which uses 2010 U.S. census data (City of Fort Worth, 2016). When comparing data from the survey respondents to data from the city of Fort Worth, the following results were noted: respondents showed a 20% higher incidence of being in the normal weight category, a 4% lower incidence of being in the overweight category, and a 15% lower incidence of being in the obese category. These

results indicate that respondents to the survey have significantly healthier body mass indices than the population of Fort Worth, Texas as a whole.

The next section of the survey focused on proximity and accessibility to The Overton Park System. It is significant to note that 77% of respondents to the survey live within a 10-minute walk from the park system and that walking was the most popular mode of transportation to the park system, with 69% of respondents reporting walking as their primary way of accessing the park. When comparing respondents' perception of accessibility with their primary mode of transportation to access the park system, the following results were noted: 80% of respondents indicated the park system was very accessible via walking or jogging and 91% or respondents reported walking or jogging as the primary mode of transportation to access the park; 97% felt the park system was very accessible via automobile, while only 35% reported using their automobile to access the park. Observations by the researcher also support this claim, noting the majority of people observed in the park were walking or jogging on the trail system while also noting very few cars in any of the parking lots. These results indicate that although a higher percentage of people feel the park is very accessible via automobile, the majority of respondents choose to be physically active when accessing The Overton Park System.

The next section of the survey focused on park usage and physical activity of respondents. While 1 to 5 park visits per month was the most popular response

to Question 7 of the survey, it is significant to note that 47% of respondents reported more than ten park visits

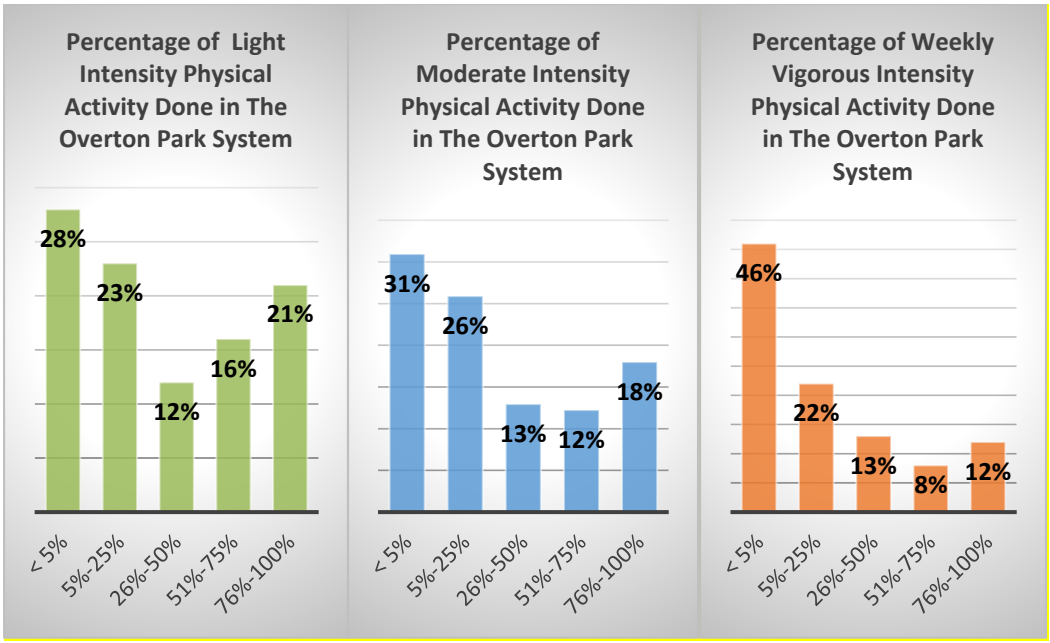

Figure 4-21 Comparison of Physical Activity Intensity Levels

Questions 10-12 focused on physical activity levels of residents and the percentage of their weekly physical activity done in The Overton Park System. When comparing the percentages of light, moderate and vigorous intensity physical activity done in the park system, it is worth noting that 49% of respondents do more than 25% of their weekly light intensity physical activity in the park system, 43% of respondents do more than 25% of their weekly moderate intensity physical activity in the park system, while only 33% of respondents do more than 25% of their weekly vigorous intensity physical activity in the park

system, see Figure 4-21 for illustrated results of these findings. The results of these questions indicate that higher percentages of respondents seem to be using The Overton Park System for light to moderate intensity physical activity rather than vigorous physical activity. These findings are reinforced by question 13 when 88% of respondents report walking as the main activity during an average visit to the parks while 37% report biking, 33% report jogging and only 11% report tennis. Question 14 also confirms these findings as 53% of respondents report mostly moderate physical activity as their normal activity level while in the park system, while 32% report mostly light intensity physical activity and only 14% report mostly vigorous physical activity. Passive observations of the researcher noted that a majority of park users were participating in light or moderate intensity physical activity and very few were participating in vigorous intensity physical activity or not being physically active. While there are some small discrepancies from question to question, overall light and moderate intensity physical activity seem to be more popular than vigorous intensity physical activity among the study population while using The Overton Park System.

The next section of the survey focused on features and amenities of The Overton Park System. Question 16 is posed to learn about the areas of the park that respondents used during average park visits. The results of this question indicate that the trail system is the most used area with 94% of respondents

reporting using it during average park visits. This finding directly corresponds to the findings in the previous section because the trail systems accommodate light and moderate intensity physical activity throughout the park system. Question 17 is a Likert scale question that asked respondents to indicate park features and amenities that are important when considering physical activity in The Overton Park System. The following features and amenities were categorized as very important: trail surface, maintenance, cleanliness, ease of access, shade trees and greenery, trash cans, proximity to house, and peacefulness and quiet. Respondents indicated the following features and amenities as being not very important: restrooms, picnic areas, parking, sports field or courts, bike racks, and outdoor fitness equipment. The review of design literature as well as researcher's personal observations reveals that features and amenities such as sports field and courts, bike racks, and outdoor fitness equipment are normally considered to be of importance when considering physical activity in parks or trail systems. It is interesting that several features and amenities that are directly related to physical activity such as sports fields or courts, bike racks, and outdoor fitness equipment were not considered important, while trash cans, which are not directly related to physical activity, were considered very important when considering physical activity in The Overton Park System. This finding was reinforced through statistical analysis as well.

The last section of the survey focused on perception of park space and how it relates to physical activity in The Overton Park System. Question 19 asked respondents to indicate to what extent they agree or disagree with statements about the park system. The results of this question indicated that the study population had a positive perception of The Overton Park System, and it is worth noting that the statement that received the highest percentage of "strongly agree" responses, at 85%, was "Overton Park offers a health benefit to people of the neighborhood." This finding is relevant to the study because it directly corresponds to the primary focus of the research study as a whole.

The last question in this section focuses on perceptions or concerns related to physical activity in The Overton Park System. Question 20 asks respondents to indicate to what extent a list or problems or concerns were perceived as a problem when considering physical activity in the park system. The results of this question indicated that none of the listed problems or concerns were considered to be a problem as a whole. The only problems or concerns that received at least a 20% response rate as a moderate problem were: Poor maintenance at 25%, and fear of crime in the park at 22%. There were not any problems or concerns that received a response rate of at least 5% as a major problem. Responses to questions in this section indicated that the study population has a positive perception of the park system as a whole and there are not any major problems or concerns that prevent physical activity in The Overton Park System.

Although it was not part of the main goal of the study the researcher in collaboration with the support of a statistician also conducted more rigorous statistical analysis to further understand relationships between various factors effecting activity levels related to park characteristics and features. The summary of the multiple regression statistical analysis findings is included as Appendix D at the end of the thesis.

Overall, the research findings from survey as well as passive observation and secondary data illustrate the following findings. The study population has a healthier BMI than the general population of Fort Worth, the State of Texas , and the United States. Moderate and light intensity physical activity seems to be the most popular activity done in the park system. The respondents that lived closest to the park system seemed to have higher responses rates regarding frequency of park usage and percentage of weekly physical activity done in the park. Proximity and accessibility were found to have significant impacts on the physical activity of residents near the Overton Park System, specifically with regard to one's ability to walk or bike to the park system as a means for transportation. The research indicates that respondents who perceive their proximity to the park system to be outside walking distance but value proximity as important tend to have a decreased amount of total time at the park and physically active time at the park. The trail system was by far the most used area of the park system with green and open space being second however the response rate was significantly

lower. The study population as a whole perceives the park to be more accessible via automobile however the overwhelming majority of respondents choose to be physically active when accessing the park system. The study population generally had a very positive perception of The Overton Park System. Respondents didn't indicate any major problems or concerns that would keep them from participating in physical activity in the park system, although many respondents indicated that they would use it more often if sidewalks access connecting their neighborhoods to the park existed.

Chapter 5 Conclusion

5.1 Introduction

The health and wellness of the United States is currently a significant cause for concern, as the nation's obesity rates and tied comorbidities continue to increase for both adults and children. While the contributing factors to these rates are multifold, an overall increasingly sedentary lifestyle is closely tied to obesity and other health concerns. The built environment plays a significant role in an individual's physical activity and other factors that are tied to obesity and health. With reduced access to outdoor recreation facilities and concerns about safely utilizing those facilities comes a decreased ability for individuals to take advantage of outdoor physical activity.

This study has analyzed the Overton Park System and the related health impacts that the park and trail system has on the residents of the nearby neighborhoods. A survey was administered to residents in order to determine their level of activity, proximity to and utilization of the park, as well as identifying their perception of security in the utilization of the park. Additionally, the researcher conducted passive observation of the park and trail system, taking field notes related to the landscape, features and amenities.

5.2 Research Questions Revisited

Four research questions were identified for this study of the Overton Park Trail System. The first research question was, "what are the physical activity levels of residents who live near the Overton Park System?" The American College of Sports Medicine recommends that adults should get at least 150 minutes of moderate intensity exercise per week (ACSM, 2016). The number of sessions and duration of each session can be variable, as long as sessions are at least ten minutes each and amount to a total of at least 150 minutes per week (ACSM, 2016). In this study, 70% of respondents reported that their usual activity level in the park was moderate or vigorous intensity exercise, and those that exercised at a moderate or vigorous level did so for an average of 51 and 55 minutes, respectively, each time they exercised, at least 3 times a week. This data demonstrates that those adults would meet the suggested activity level during their activity sessions. While not all of this physical activity took place in the park, almost all respondents reported using the park for physical activity at least once a week.

The second research question asked, "to what extent do park features and amenities impact physical activity of residents near the Overton Park System?" The statistical analysis indicated that the park features, including picnic areas, playground areas, trash cans, bike racks, and proximity to house have significant

impacts on the physical activity of residents near the Overton Park System. Those individuals that valued park seating and playground equipment more, but felt those amenities were not sufficient, spent significantly less time on vigorous physical activity. While the presence of seating and playground equipment do not seem to be logically tied to an individual's ability to perform vigorous activity, these features may play a role in the individual's overall perception of and desire to spend time in the park.

The third research question examined to what extent proximity, connectivity and accessibility impact the physical activity of residents near the Overton Park System. Overall, survey data indicated that residents viewed the park system to be very accessible for walking, jogging, bicycling, and rollerblading. The majority of residents access the trail by simply walking to it, though other users reported biking, driving, or running to access the park system. Statistical analysis revealed that proximity and accessibility have significant impacts on the physical activity of residents near the Overton Park System, specifically with regard to one's ability to walk or bike to the park system as a means for transportation. The closer and more easily accessible an individual perceived the park to be, the more they utilized the park for physical activity.

The final research question considered to what extent the perceptions of the park space and experience impact physical activity of residents near the

Overton Park System. Statistical analysis of survey responses indicated that there is no significant impact on the physical activity of residents near the Overton Park System due to perceptions of park space and experiences, including concerns about the park. However, qualitative comments did include specific concerns related to particular challenges such as a lack of restroom facilities, maintenance issues, and safety. Some responses indicated that the presence of restrooms and improved perceptions of safety would lead them to use the park more frequently and for a wider variety of activities.

5.3 Implications for Design and Planning

Overall, the results generally supported existing literature in that close proximity and ease of access to parks and trail systems is resultant in increased physical activity levels for surrounding residents. According to Fort Worth's FitWorth Movement, "A community can't thrive when its members aren't choosing a healthy way of life" (www.fitworth.org, 2016). The research supports the built environment as an important contributor to community members engaging in healthy outdoor activity. Thus, community leaders and planning and design firms should carefully consider the attributes of outdoor spaces and how design supports ease of access to parks and trail systems. The importance of

these considerations cannot be overstated, particularly in the midst of a rapidly growing community.

5.4 Relevance to Landscape Architecture

This thesis research is relevant to the profession of landscape architecture as it directly relates to the health and welfare of the general public. Physical activity has become a very relevant topic of discussion due to its relationship to health. One of the missions and foundations for licensure in landscape architecture is to protect the health, safety, and welfare of the public. The connection this study provides between parks and trail systems with the health benefits that they provide, specifically in The Overton Park System, can be used to guide landscape architecture designs and their influence on master planning for future development.

One of the code of ethics for landscape architects according to www.asla.org states, "Landscape Architects should make every effort within our sphere of influence to enhance, respect, and restore the life-sustaining integrity of the landscape for all living things." Protecting environmentally sensitive areas for park space and ensuring that green and open space are preserved in future development projects and urban revitalization efforts should be a major concern for the future of landscape architecture. The findings from this study and related studies helps reinforce the importance of the profession of landscape architecture

and its role in enhancing, respecting, and restoring the life sustaining integrity of the landscape for all living things. One of the missions and foundations for licensure in landscape architecture is to protect the health, safety, and welfare of the public and providing parks and trail systems directly relates to this mission by providing space that contributes to health of neighborhoods and communities. Knowing the health impacts that parks and trail systems have on their surroundings within the urban context, helps the landscape architect validate their stance on protecting environmentally sensitive areas, providing habitat for native flora and fauna, providing green and open space for people of the community to take advantage of the health benefits of being outdoors and participating in physical activity.

5.5 Future Research Opportunities

This section discusses future avenues of research related to the topic of health impacts of parks and trail systems. The study opens the door to exploring The Overton Park System in Fort Worth, Texas, but much work remains to be done in order to better understand the topic in full. In light of Fort Worth's efforts to embrace health as a city priority, studies in other parts of the city and in varying socioeconomic neighborhoods should be conducted to study how parks and trails through these areas are impacted by larger parks and trail systems. In

addition to varying socioeconomic groups, other age groups can be studied as an extension of this research. The health benefits offered by parks and trail systems can be argued not only by the impacts they have on human beings, but also the health of the environment as a whole.

Appendix A

Institutional Review Board Approval

NOTIFICATION OF EXEMPTION

INFORMAED CONSENT DOCUMENT

Institutional Review Board
Notification of Exemption

February 26, 2016

Jacob Tackett Schwarz
Dr. Taner R. Ozdil
Architecture
Box 19108

Protocol Number: 2016-0411

Protocol Title: *Health Impacts of Parks and Trails Systems; Lessons Learned from the Overton Park System, Fort Worth, Texas*

EXEMPTION DETERMINATION

The UT Arlington Institutional Review Board (IRB) Chair, or designee, has reviewed the above referenced study and found that it qualified for exemption under the federal guidelines for the protection of human subjects as referenced at Title 45CFR Part 46.101(b)(2).

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:(i) information obtained is recorded in such a manner that human subjects can be identified, either directly or through identifiers linked to the subject; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

You are therefore authorized to begin the research as of **February 26, 2016**.

Pursuant to Title 45 CFR 46.103(b)(4)(iii), investigators are required to, "promptly report to the IRB ***any*** proposed changes in the research activity, and to ensure that such changes in approved research, during the period for which IRB approval has already been given, are **not initiated without prior IRB review and approval** except when necessary to eliminate apparent immediate hazards to the subject." All proposed changes to the research must be submitted via the electronic submission system prior to implementation. Please also be advised that as the principal investigator, you are required to report local adverse (unanticipated) events to the Office of Research Administration; Regulatory Services within 24 hours of the occurrence or upon acknowledgement of the occurrence. All investigators and key personnel identified in the protocol must have documented Human Subject Protection (HSP) Training on file with this office. Completion certificates are valid for 2 years from completion date.

The UT Arlington Office of Research Administration; Regulatory Services appreciates your continuing commitment to the protection of human research subjects. Should you have questions or require further assistance, please contact Regulatory Services at regulatoryservices@uta.edu or 817-272-2105.

UT Arlington
Informed Consent Document

PRINCIPAL INVESTIGATOR
Jacob Schwarz; Program in Landscape Architecture; jacob.schwarz@mavs.uta.edu

FACULTY ADVISORS
Dr. Taner Ozdil Ph.D., ASLA; tozdil@uta.edu
Dr. Pat D. Taylor Ph.D., ASLA, FCELA; pdt@uta.edu

TITLE OF PROJECT
Health Impacts of Parks and Trail Systems; Lessons Learned from the Overton Park System, Fort Worth, Texas

INTRODUCTION
You are being asked to participate in a research study about the health impacts of parks and trail systems. Your participation is voluntary. Your refusal to participate or discontinuing your participation at any time will involve no penalty or loss of benefits to which you are otherwise entitled. Please ask if there is anything you do not understand.

PURPOSE
The purpose of this study is to research the health impacts of parks and trail systems by focusing on physical activity levels of residents near The Overton Park System (in this study defined as Overton Park, Foster Park and/or the associated urban trails) in Fort Worth, Texas.

DURATION
Participation in this study will last approximately 15 minutes.

NUMBER OF PARTICIPANTS
The number of anticipated participants in this study is 2000.

PROCEDURES
The procedures which will involve you as a research participant include:

1) You will be asked to take a brief online survey about your physical activity level and park usage. Your response to any question is voluntary.

2) You have the opportunity at the conclusion of the survey to add comments or anything else to your responses.

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POSSIBLE BENEFITS
Data collected through the survey can help form a knowledge base to better understand the health impacts of parks and trail systems to area residents.

POSSIBLE RISKS/DISCOMFORTS
There are no perceived risks or discomforts for participating in this research study. Should you experience any discomfort please inform the researcher, you have the right to quit the survey at any time.

COMPENSATION
No monetary compensation is offered to participants in this study.

ALTERNATIVE PROCEDURES
There are no alternative procedures for this research. You have the right to refuse to participate or quit at any time during the survey process.

VOLUNTARY PARTICIPATION
Participation in this research study is voluntary. You have the right to decline participation in any or all study procedures or quit at any time at no consequence.

CONFIDENTIALITY
Every attempt will be made to see that your study results are kept confidential. All data collected including transcriptions from this study will be stored in the office of Dr. Taner R. Ozdil in Room #417 of the UTA Architecture Building for at least three (3) years after the end of this research. The results of this study may be published and/or presented at meetings without naming you as a participant. Additional research studies could evolve from the information you have provided, but your information will not be linked to you in anyway. Although your rights and privacy will be maintained, the Secretary of the Department of Health and Human Services, the UTA Institutional Review Board (IRB), and personnel particular to this research have access to the study records. Your records will be kept completely confidential according to current legal requirements. They will not be revealed unless required by law, or as noted above. The IRB at UTA has reviewed and approved this study and the information within this consent form. If in the unlikely event it becomes necessary for the Institutional Review Board to review your research records, the University of Texas at Arlington will protect the confidentiality of those records to the extent permitted by law.

IRB Approval Date: FEB 2 6 2016

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Informed Consent Document

CONTACT FOR QUESTIONS
Questions about this research study may be directed to Jacob Schwarz, Dr. Taner R. Ozdil, or Dr. Pat D. Taylor. Any questions you may have about your rights as a research participant or a research-related injury may be directed to the Office of Research Administration; Regulatory Services at 817-272-2105 or regulatoryservices@uta.edu.

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CONSENT
By choosing to proceed with completing this survey, you confirm that you are 18 years of age or older and have read or had this document read to you. You have been informed about this study's purpose, procedures, possible benefits and risks, and you have received a copy of this form. You have been given the opportunity to ask questions before you participate, and you have been told that you can ask other questions at any time.

You voluntarily agree to participate in this study. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue participation at any time without penalty or loss of benefits, to which you are otherwise entitled.

IRB Approval Date: FEB 2 6 2016

Appendix B

Survey Hardcopy

HEALTH IMPACTS OF PARKS AND TRAIL SYSTEMS

LESSONS LEARNED FROM THE OVERTON PARK SYSTEM, FORT WORTH, TEXAS.

HEALTH IMPACTS OF PARKS AND TRAIL SYSTEMS
LESSONS LEARNED FROM THE OVERTON PARK SYSTEM, FORT WORTH, TEXAS.

OVERTON PARK SYSTEM Description and Map

For this research Overton Park, Foster Park, and their trail system that connects them to the Trinity Trail System will be referred to as the Overton Park System.

This page provides DEMOGRAPHIC information

What is your gender?

❍ Male

❍ Female

What is your age?

Years _____

What is your current height?

Feet _____

Inches _____

What is your current weight?

Pounds _____

Do you have any disabilities preventing you from participating in light physical activity (such as walking slowly, stretching, playing catch) moderate physical activity (such as walking briskly, bicycling 8-12 mph, light calisthenics) or vigorous physical activity (such as jogging/running, bicycling 14-18 mph, vigorous calisthenics)? (select all that apply)

❑ Light physical activity

❑ Moderate physical activity

❑ Vigorous physical activity

The questions in the first section relate to PROXIMITY and ACCESSIBILITY to the Overton Park System.

1. Which park(s) do you primarily use? (please check all that apply)

❍ Overton Park
❍ Foster Park
❍ Connecting trail system to Trinity Trail

2. How long would it take for you to walk from your house to the closest area of the Overton Park System?

❍ 1-5 minutes
❍ 6-10 minutes
❍ 11-15 minutes
❍ 15-25 minutes
❍ More than 25 minutes

3. What is the nearest residential street intersection to your house?

_____

4. What is your address?
(optional - will only be used to determine how far you live from the Overton Park System)

_____

5. How ACCESSIBLE is the Overton Park System from your house using the following modes of transportation?

	Very Accessible	Somewhat Accessible	Not Very Accessible
Walking/jogging	❍	❍	❍
Riding bicycle	❍	❍	❍
Driving car	❍	❍	❍
Rollerblading/skateboard	❍	❍	❍

6. How do you typically get from your house to the Overton Park System? (check all that apply)

- ❑ I walk
- ❑ I jog or run
- ❑ I ride my bicycle
- ❑ I drive my car
- ❑ I rollerblade or skateboard

The questions in this section provide information about PARK USAGE and PHYSICAL ACTIVITY levels.

7. How many times do you visit the Overton Park System in a typical month?

- ❍ 0
- ❍ 1-5
- ❍ 6-10
- ❍ 11-15
- ❍ 16-20
- ❍ 20+

8. How much time do you spend in the park during an average visit?
   Hours _____
   Minutes _____

9. Of the time spent in the park, how much time do you spend being physically active (doing any physical movement rather than sitting such as walking, jogging, biking) during a normal visit?
   Hours _____
   Minutes _____

10. How many days per week do you participate in light intensity physical activity (causes small increases in breathing and heart rate) for at least 10 minutes at a time? (not limited to park)

- ❍ 0
- ❍ 1
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7

10a. On days when you do light intensity physical activity, how much total time per day do you spend doing these activities?
   Hours _____
   Minutes _____

10b. What percentage of your weekly light intensity physical activity is done in the Overton Park System?

- ❍ < 5%
- ❍ 5%-25%
- ❍ 26%-50%
- ❍ 51%-75%
- ❍ 76%-100%

11. How many days per week do you participate in moderate intensity physical activity (causes moderate increases in breathing and heart rate) for at least 10 minutes at a time? (not limited to park)

- ❍ 0
- ❍ 1
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7

11a. On days when you do moderate intensity physical activity, how much total time per day do you spend doing these activities?

Hours _____

Minutes _____

11b. What percentage of your weekly moderate intensity physical activity is done in the Overton Park System?

- ❍ < 5%
- ❍ 5%-25%
- ❍ 26%-50%
- ❍ 51%-75%
- ❍ 76%-100%

12. How many days per week do you participate in vigorous intensity physical activity (causes large increases in breathing and heart rate) for at least 10 minutes at a time? (not limited to park)

- ❍ 0
- ❍ 1
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7

12a. On days when you do vigorous intensity physical activity, how much total time per day do you spend doing these activities?

Hours _____

Minutes _____

12b. What percentage of your weekly vigorous intensity physical activity is done in the Overton Park System?

- ❍ < 5%
- ❍ 5%-25%
- ❍ 26%-50%
- ❍ 51%-75%
- ❍ 76%-100%

13. What activities do you do during your average visits to the Overton Park System (check all that apply)

- ❑ Walking
- ❑ Jogging
- ❑ Biking
- ❑ Rollerblading/skating
- ❑ Picnicking
- ❑ Relaxing/reading
- ❑ Tennis
- ❑ Wildlife viewing
- ❑ Playing with kids
- ❑ Watching kids on playground
- ❑ Other(s) _____

14. Which best describes your activity level on a normal visit to the Overton Park System?

- ❍ Mostly sitting
- ❍ Mostly light physical activity (walking or strolling at a slow pace)
- ❍ Mostly moderate physical activity (walking or biking at a moderate pace)
- ❍ Mostly vigorous physical activity (vigorous jogging, running, or biking)

15. Who accompanies you when you visit Overton Park? (check all that apply)

- ❑ I go alone
- ❑ Family
- ❑ Friends
- ❑ Pet
- ❑ Members of an organized group
- ❑ Other (s) _____

The next 2 questions relate to PARK FEATURES

16. What areas of the Overton Park System do you use during your visits? (check all that apply)

- ❑ Trail system
- ❑ Tennis courts
- ❑ Playground
- ❑ Green/open space
- ❑ Picnic area
- ❑ Duck pond
- ❑ Creek
- ❑ Other(s)_____

17. When thinking about being physically active in Overton Park, how important or unimportant is each of the following features or amenities?

	Very unimportant	Unimportant	Neither	Important	Very Important
Seating	❍	❍	❍	❍	❍
Peacefulness/quiet	❍	❍	❍	❍	❍
Easy access	❍	❍	❍	❍	❍
Lighting	❍	❍	❍	❍	❍
Drinking fountains	❍	❍	❍	❍	❍
Restrooms	❍	❍	❍	❍	❍
Parking	❍	❍	❍	❍	❍
Cleanliness	❍	❍	❍	❍	❍
Maintenance of park areas	❍	❍	❍	❍	❍
Proximity to house	❍	❍	❍	❍	❍
Trash cans	❍	❍	❍	❍	❍
Being near the creek	❍	❍	❍	❍	❍
Shade trees and greenery	❍	❍	❍	❍	❍
Bike racks	❍	❍	❍	❍	❍
Trail surface	❍	❍	❍	❍	❍
Picnic areas	❍	❍	❍	❍	❍
Playground areas	❍	❍	❍	❍	❍
Green open space	❍	❍	❍	❍	❍
Outdoor fitness equipment	❍	❍	❍	❍	❍
Sports fields/courts	❍	❍	❍	❍	❍

18. Are there other features or amenities which may be important but not listed in the previous question?

_____

__

The last 2 questions relate to your PERCEPTION of Overton Park

19. Please indicate how much you agree or disagree with each statement.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Overton Park is clean	❍	❍	❍	❍	❍
Overton Park has features/amenities that I am interested in	❍	❍	❍	❍	❍
Overton Park is attractive	❍	❍	❍	❍	❍
Overton Park is safe	❍	❍	❍	❍	❍
Overton Park is well maintained	❍	❍	❍	❍	❍
Overton Park offers a health benefit to people of the neighborhood	❍	❍	❍	❍	❍

20. Please indicate to what extent the following problems/concerns keep you from participating in physical activity as often as you would like in Overton Park.

	Not a problem	A minor problem	A moderate problem	A major problem
Fear of crime in the park	❍	❍	❍	❍
Lack of scenic beauty	❍	❍	❍	❍
Poorly maintained (such as overgrown plants or excess trash)	❍	❍	❍	❍
Park is not designed for the activities I want to do	❍	❍	❍	❍
Fear of injury (poorly maintained trail and benches)	❍	❍	❍	❍
Park is too far away from my house	❍	❍	❍	❍
I am physically active elsewhere	❍	❍	❍	❍
Lack of information on physical activity opportunities at the park	❍	❍	❍	❍
Lack of transportation to the park	❍	❍	❍	❍
I don't feel welcome at the park	❍	❍	❍	❍
I have a conflict with other park users	❍	❍	❍	❍

21. Are there other problems/concerns that keep you from participating in physical activity as often as you would like in the Overton Park System?

_____

22. Do you have any other comments or suggestions about the health impacts of Overton Park?

_____

Thank you for your time spent taking this survey.

Appendix C

Write in Responses to Question 22 of Survey

Respondents un edited quotes listed in no particular order

It would be nice to see the playground updated and additional equipment added, particularly structures for older elementary school aged children. The playground is very busy between 3:00-4:30 on school days.

Would be great to have some public restrooms in the park. Sometimes I get very far from my house and have to use the restroom. I've seen coin operated port-a-pottys in Europe. I wonder if this would be a reasonable option.

It is a very important part of the neighborhood for me and my dog. I would like more dog fountains.

It is beautiful and I do pass it everyday. A little far for my walking routine however

Litter problem in creek areas

The trash along the river is an embarrassing eyesore. Several people have commented on the fact there are crews cleaning on the top of the riverbanks, while the riverbank itself look like a sewage drain. There need to be more garbage bins and designated recycling container. The increased commercial construction along the greenbelt is having a negative impact on the wildlife and the perception of the Trinity River and adjacent park system is suffering. On the positive side, the resurfacing of the trails while keeping the parallel non surfaced trail for runners and walkers is very helpful.

Being outdoors makes us healthier, and probably more protective of our habitat.

The only problem we have encountered are people with dogs. Some use long leashes and allow their dogs to take up the trail path not allowing bikers or joggers by. They also let dogs get close to bikers which could cause an injury. They leave dog excrement in the path.

The park should be connected better for those in TCU who are part of Tanglewood but have limited access via walking or cycling.

We LOVE our park!

It is mind-boggling that the park complex maintenance is not a high level priority, including the creek bed and banks. If the system were protected and cultivated it

would be an important positive contribution to the overall quality of the Trinity River watershed.

An excellent walking trail. Bikes can sometimes be a problem for residents walking on the trail
I love the park! Let's figure out how to keep the creek clean and beautify the hills down to the creek - they seem kinda ugly and not maintained. Otherwise - the park is beautiful!

There are a few areas in the park that could use water accessibility for pets. Some of the fountains are not working and there are no fountains north of Bellaire Drive toward Foster Park.

Love the variety of landscapes and the creek. When my children were younger we spent a lot of time exploring the creek area, finding fossils ... It is also so nice to have the large trees and the shade.
I am grateful for Overton Park and the beautiful residential community which surrounds and supports it. I feel safe and love seeing the elderly, those training for marathons, school children, families with small children, couples and groups of friends all enjoying the park(s) in harmony. I feel blessed to be a part of this community.

The stagnant water is an issue unfortunately. It smells terrible and our pets can't drink it!

There is a great deal of interest in the park. Our trees are an important part of what makes Fort Worth
beautiful. We are losing so many when new homeowners cut down trees to build larger homes, so trees in the park are even more important to preserving at least part of our heritage; Thank you!

Lighting could be improved on the streets surrounding the park. Many people are in the park long before the sun comes up each morning and it is very dark. Many of us carry some light

I am grateful every day for the Overton Park System.

This park is the major reason we continue to live in this neighborhood. The green spaces, the safety of the park, the trail system are all strengths. I do wish there were more water fountains, a restroom somewhere; if there were, probably more people would get out and enjoy it. Aesthetically, it would be wonderful if the creek could be cleaned up more often of its trash, and those rocks in their wire cages with the black plastic could somehow be planted with growth so that that

particular ugliness could be hidden. From what I understand, there are some different governmental jurisdictions (corps of engineers, city/county water authorities) that take care of different areas of the park. The area north of the footbridge between Ranchview and Bellaire is a different jurisdiction than the area south - so we have the pretty natural growth on the banks south of the bridge and the scalped banks on the north side. I am glad the tennis courts have been spiffed up and look forward to using them sometime soon. The benches are especially wonderful for those who might not have a backyard (apartment dwellers). The park should serve all ages and needs for rest, quiet, wildlife appreciation and physical activity.

We love the park and the area.

Sidewalks to the park from Berry St. would be nice.

great park

The water could be cleaner. The creek itself is often filled with trash & the water is murky, especially at the Foster Park end. Of course, when you take kids there, they want to wade in the park. Sometimes it is downright disgusting.

Love the park. I wish we had more running trails (less concrete) but am happy to have it.
I grew up in the Park Cities in Dallas that have wonderful parks. I believe the Overton Park System is on par with that park system and that is saying something. Fort Worth has always provided and maintained wonderful parks and recreation areas. I have traveled the world and Fort Worth should be proud of what the have provided for generations of families.

we need more parks like Overton.

Feed and trim the trees. Install running path

A public restroom might be nice

the park is very desirable to my wife and me. I enjoy seeing neighbors, adults and children using the park.
Needs sand volleyball and a community garden

I would love to see more of the underbrush and vines that obscure the view of the creek to be taken down. Also would help to see dead limbs that have or are trying to fall from trees to be cut or hauled away. We love the park and would love to see it better maintained.

More trashcans might help.

I love that the park is so close by the house.

My husband and I took our dog for a walk from our house by TCU across from the Greek housing down to foster park. First big issue is that from the great TCU trail we had to walk down busy Bellaire with no sidewalk! We thought it was a nice day but our dog was very thirsty and hot when we got to foster park, and the water fountains were not working to give her any water (with our hands since there are no dog accessible ones). The water from the creek had lots of green "scum" and we weren't comfortable letting her drink that instead. We used to live in Dallas and loved white rock lake and Katy trail- Fort Worth seems very behind those models in terms of upkeep, technology, and user/dog-friendliness. We fully support more advancements towards Overton park!! Thank you for taking the time to survey our neighborhood.

In the Botanical gardens there are both recycle and trash bins. This park needs both and some sort of campaign to encourage others not to litter. Our poor creek is full of trash

It bothers me that people litter and it gets caught up in the creek in Overton Park.

The walking path on the Hartwood (north) end is not as level and smooth as the majority of the path.

I'd love to see exercise stations in the Overton Park section of the park

More opportunities (frequency) for community cleanup of the creek.

Just a quick note I utilize the Trinity trail system down off of Bellaire & hulen everyday where I walk my dogs basically 365 days a year. Only thing that keeps us from going would be heavy lightning. There are times when I walked from my house, therefore I walk through the Overton trails or I jog through there on a daily basis but I don't use those facilities as much as I use the facilities of the trail system down on the actual River. I just want you to know that I believe very strongly in the Overton Park system even though I do not personally use it as much as the people that live along the Overton Park Streets. I walk my dogs off leash and it's more difficult to do that in the Overton Park, Foster Park area just to be a good dog neighbor walking large dogs off leash is not as accepted in a neighborhood environment, therefore that affects how many times I'm actually using those facilities. But I support that area 100% as an active environment and a beautiful environment for my neighborhoods.

Playground by Tanglewood should be expanded, needs to be updated and have more equipment. Also there should be a playground area in the Overton Park side, there's plenty of room.

Observe many folks like me walking, running, biking and just relaxing a the Park

Let's keep it clean and use it often. Great place to meet the neighbors.

Just to add that the addition of restrooms and water fountains would greatly improve the Trinity Trail System.

Thanks for the study; good luck with your master's degree.

Neighbor's are friendly. Great way for kids to walk/ride bikes to nearby elementary school. Families are out using the park and trails as quality time together. The kids grow up with a higher appreciation of nature and time outside. Lots of animals inhabit the creek and park area as well. Wonderful opportunity for city families to feel close to nature.

Overton Park, in the 2 years that I have lived here, is NOT being maintained. There are Many dead branches and branches ready to fall on visitors at any moment! The creek bed right in front of my house is jammed with limbs,bottles, styrofoam,trash, and it smells like a sewer when I cross over it. We have reported it several times and maybe twice a year it is cleared. Duck have to get out of the water to get on he other side of a crossing. I will be happy to speak with someone about this location.

This is generally a lovely park, but like all parks, security should be a concern and dramatically beefed up.

It is a wonderful addition to the city. it is unique. do not build anything on it, for example a bathroom. That will lead to areas of crime. there is no need for a bathroom, as it will just be a source of stench and will make the park start to look like just another average park. It would also run off the wildlife (raccoons, foxes, possums, etc) It is great as it is. I wouldn't change a thing, other than have the City be finished with all of the construction on the adjoining streets. You could plant a bunch of flowers if you wanted, but don't change or add anything.

I love the park! I wish they would add playground equipment for older kids.

We're lucky to have it. We need more parks everywhere and to do as much as possible to conserve green spaces in our urban environments.

I think the park has a lot of potential

.

Appendix D

Statistical Analysis

Emily Hously and Jacob Schwarz

Statistical Analysis

Statistical analysis was used to find answers to the research questions of the study. In order to test the research questions regarding the impacts that features and amenities; proximity, connectivity, and accessibility; and perception and experience have on the physical activity of residents, multiple regression was run on several different dependent variables. These responses used as dependent variables include time spent at the park, time spent at the park being physically active, daily time spent doing light intensity physical activity, daily time spent doing moderate intensity physical activity, and daily time spent doing vigorous intensity physical activity. The independent predictor variables used in each of these regression models include the distance one lives away from the park; the level of accessibility to the park through walking, running, biking, driving and skateboard/rollerblades; the common method of transportation one uses to get to the park; the various features available at the park; various perceptions of the park; and concerns about the park. The levels of measurement for each of these variables is outlined in the table below.

Variable	**Research Question**	**Level of Measurement**
Dependent Variables		
Time at Park (minutes)	All	Continuous
Active Time at Park (minutes)	All	Continuous
Daily Light Activity (minutes)	All	Continuous
Daily Moderate Activity (minutes)	All	Continuous
Daily Vigorous Activity (minutes)	All	Continuous
Independent Variables		
Distance from park (minutes)	RQ3	Continuous
Accessibility to Park (walking, biking, driving, skateboard/blades)	RQ3	Continuous (Scale)
Common Travel Methods (walk, run, bike, car, skateboard/blades)	RQ3	Categorical

Features (20 types)	RQ2	Continuous (Scale)
Perceptions of Park (6 types)	RQ4	Continuous (Scale)
Concerns of Park (11 types)	RQ4	Continuous (Scale)

Statistical Variables

Multiple regression requires that there be no significant multicollinearity and that the residuals exhibit approximate normality and homogeneity of variance. Of these assumptions, the homogeneity of variance was violated for each model, but this was resolved when each of the response variables were transformed using a square root function. Results indicated no significant fit for predicting time spent in the park ($F=1.019$, $p=0.46$), active time spent at the park ($F=1.046$, $p=0.42$), daily time spent doing light physical activity ($F=1.229$, $p=.20$), and daily time spent doing moderate physical activity ($F=0.803$, $p=.791$). However, the overall model predicting daily time spent doing vigorous activity was significant ($F=1.598$, $p<.05$).

For the significant model predicting daily time spent doing vigorous intensity physical activity, the common methods of transportation through running and biking were both significant, both having a positive effect on time spent doing vigorous activity when the participant chose these methods of transportation to the park. ($t=-2.66$, $p<.01$ for biking; $t=-2.46$, $p<.02$ for running). Additionally, the park features for importance of good seating, picnic areas, and playground areas were also significant in predicting daily time spent doing vigorous activity ($t= 2.81$, $p<.02$ for picnic; $t=-2.47$,$p<.02$ for playground; $t=-2.52$, $p<.02$ for seating). For each added level of indicated importance for seating and playground areas, participants spent significantly less time on vigorous activity. The opposite was true for picnic areas, with respondents spending significantly more time on vigorous activity for each additional level of indicated importance for picnic areas.

Although all other regression models were not significant overall, there were some significant individual variables found. For the model predicting time spent at the park, the variables measuring proximity as a concern of the park and walking as a common transportation method to the park both had a negative effect when walking was not a common method and for each level increase in indicated importance for proximity ($t=-2.02$, $p<.05$ for walking; $t=-2.95$, $p<.01$ for proximity). For the model predicting physically active time spent at the park, these same two variables were significant ($t=-2.32$, $p<.03$ for walking; $t=-2.22$, $p<.03$ for proximity) This indicates that those who are not close enough to walk to the park but value proximity as important tend to have a decreased amount of total time at the park and physically active time at the park. For the model predicting

daily time spent doing light physical activity, the feature variables for the relative importance of trash cans and bike racks were both positively significant in increasing light physical activity ($t=2.12$, $p<.04$ for both bike racks and trashcans). For the model predicting the daily time spent doing moderate physical activity, the feature variable for the relative importance of picnic areas had a positive significant effect on increasing daily time spent doing moderate activity ($t=2.71$, $p<.01$).

With regard to research question two, the results of these tests indicate that park features including picnic areas, playground areas, trashcans, bike racks, and proximity to house have significant impacts on the physical activity of residents near the Overton Park System. Results for results for research question three indicate that proximity and accessibility have significant impacts on the physical activity of residents near the Overton Park System as well, specifically with regard to one's ability to walk or bike to the park system as a means for transportation. Finally, results for research question four indicate that there is no significant impact on the physical activity of residents near the Overton Park System due to perceptions of park space and experiences, including concerns about the park

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Biographical Information

Jacob Schwarz holds a Bachelor's Degree in Exercise Physiology from Texas Tech University. He has 10 years of experience working in the healthcare setting with personal training, stress testing, injury prevention, sports performance, and exercise prescription. He holds certifications as: Certified Strength and Conditioning Specialist (CSCS) from the National Strength and Conditioning Association (NSCA) and Master Fitness Specialist from the Cooper Institute. His background and interest in health and wellness led him to choose a thesis topic related to the role of the built environment on community members' health focusing on physical activity.

Jacob helped lead a team who's design project won first place in the master plan category of the 2015 EPA Campus Rainworks Challenge national design competition. The project also received an Honor Award from Texas ASLA. He was also the recipient of 2015 Richard B Myrick Scholarship and 2015 Texas ASLA Scholarship Endowment.