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Public space and well-being: an empirical study of Central Park in Old Louisville.

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PUBLIC SPACE AND WELL-BEING: AN EMPIRICAL STUDY OF CENTRAL PARK IN OLD LOUISVILLE

By

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A Dissertation Approved on

July 11, 2023

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DEDICATION

This dissertation is dedicated to my strong, loving, and determined mother, Molouk Iraj, for instilling in me the value of education, hard work, patience, and perseverance,

In loving memory of my father, Mohammad Nasser (1947 – 1989), whom I wish had lived long enough to witness my success, celebrate my accomplishments, and see his dreams come true for his little daughter (Daddy's Philosopher),

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ABSTRACT

PUBLIC SPACE AND WELL-BEING: AN EMPIRICAL STUDY OF CENTRAL PARK IN OLD LOUISVILLE

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Urban green spaces have been receiving attention in urban planning and the health profession in the 21st century as environmental elements that contribute to well-being. This dissertation explored the relationship between green space usage and individuals' physical, mental, and social well-being. This empirical research focused on Central Park in Old Louisville to examine how residents use the park and whether it contributes to the well-being of residents. After exploring the existing literature, I identified four well-being indices: (1) perceived health (PHI), (2) health outcome (HOI), (3) mental well-being (MWI), and (4) social well-being (SWI). Frequent Park usage is expected to positively impact these measures. The survey questionnaires were distributed to all residential units (single and multi-family houses, apartments, and senior housing) in the study area. This survey collected information regarding individuals' park usage patterns, activities, physical, mental, and social well-being status, and their socioeconomic characteristics.

The multi-linear regression results showed that frequent park usage has positive but insignificant, impacts on participants' physical, mental, and social well-being. Implementing interaction terms to assess the impact of frequent park usage on well-being measures, did not improve the results, either. However, using Central Park for socializing and attending social events contributes significantly to individuals' social well-being. The log-linear regression models revealed consistent positive impacts of frequent park usage for social events on residents' social well-being. Further, one of the log-linear models (Model 3) also uncovered positive and significant (at the 5% significant level) impacts on the health outcome index. The results of both models suggest that gender, age, and income played statistically significant roles in promoting respondents' general health, health outcomes, mental and social well-being.

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CHAPTER I INTRODUCTION

The sedentary life and workstyles of the 21st century and their associated illnesses (e.g., obesity, cancer, higher cardiovascular disease rates, and diabetes) have restored urban planners and health professionals' attention to the health-promoting benefits of public spaces (especially in dense urban areas). The attempts appear to be the convergence of once-allied professional efforts of American city officials, landscape architects, and health professionals to rid their fellow citizens of the filthy, unhealthy, and disease-causing conditions of the 19th-century industrial cities (Szczygiel, 2000; Duffy, 1971). Despite the lack of proven evidence for the causal relationship between the physical environment and individuals' health, empirical and experimental studies indicate that various aspects of the built environment can contribute to public health (Rao, 2007). For instance, well-distributed and quality public green spaces contribute to noise and pollution reduction (Riggs, 2021). They can encourage physical activities and reduce urban health issues, such as inactive, age-related, and non-communicable diseases (Rao, 2007; Sarkar, 2017; Lowe, 2014; Frank, 2001).

The existing empirical studies indicate the importance of open spaces, green infrastructure, and parks in promoting the quality of life and well-being in urban areas (Enssle, 2020; Fang, 2021). Studies indicate that public green spaces can contribute to the quality of life (Camargo, 2017; Ambrey, 2014), happiness (Benita, 2019), physical health

(Bozkurt, 2021; Deng, 2020), mental/subjective/emotional wellness (Coldwell, 2018; White, 2021; Marselle, 2014), and social well-being of citizens (Aram, 2019; Baur, 2013).

While studies on the relationship between public green spaces and community well-being are conducted at all levels (from global to local scales), several factors render the importance of more contextual studies. First, public spaces are perceived and used differently across cultures, lifestyles, and countries. Second, disease rates and diagnostic definitions can vary by geography and location (Ruiz, 2020; Crimmins, 2010). Hence, conducting contextual empirical studies informs local urban planners, policymakers, and city managers about the functioning of the city's green infrastructure. Thus, this dissertation focused on Central Park in the Old Louisville neighborhood, one of the densest urban areas in Jefferson County, KY. It attempted to provide a contextual instance by exploring the contribution of Central Park to the Old Louisville community's physical, mental, and social well-being.

Empirical research on the relationship between public green spaces and well-being examines one or more aspects of well-being. For instance, some investigate the impact of urban parks on physical well-being (e.g., reducing the risk for cardiovascular diseases and BMI) (Yeager R. R., 2018; Epstein, 2012), mental well-being (e.g., depression) (Miles, 2012; Pun, 2018), social well-being (Baur, 2013), or the overall health (Sturm, 2014). The current research focuses on three aspects of well-being (physical, mental, and social) and aims to explore whether and how Central Park contributes to the well-being of Old Louisville residents. To achieve this aim, I utilized a quantitative method to assess the relationship between Central Park usage and residents' physical, mental, and social well-being.

This dissertation will work to respond to three research questions. First, how do Old Louisville residents use Central Park? The frequency, duration, regularity, and purposes of park visits along with the information about users' perception of the quality of the park will allow interpretation of park quality and areas that need further attention (e.g., facilities and safety). Second, does frequent park usage improve residents' physical and mental health, and third, does Central Park contribute to community social well-being? Studies suggest that frequent green space usage contributes to people's well-being. It can reduce blood pressure and the risk of cardiovascular disease (Modesto, 2021), encourage physical activity (Almanza, 2012), reduce stress and anxiety (Hazer, 2018; Yin, 2022), and increase the chances for social interaction, gaining a sense of community and social capital (Baur, 2013; Burgess, 2021). It is necessary to identify park quality to uncover the second and third questions, since the characteristics of a physical environment are crucial for ensuring people's presence. People favor welcoming, safe, comfortable, and accessible public spaces (Carmona, 2010 b; Mehta, 2009; Nemeth, 2011).

The following chapter reviews the literature on public space and its contribution to three aspects of well-being: physical, mental, and social. Chapter 3 describes the quantitative methodology implemented to answer the research questions. Chapter 4 presents the survey design and introduces the study area and data collection. Chapter 5 provides a descriptive analysis of data on well-being measures. Chapter 6 describes the demographic attributes of respondents, park usage activities, and respondents' perceptions of the quality of the park. Chapter 7 presents whether park usage impacted participants' physical, mental, and social well-being. The chapter presents the results of the regression analysis. The final chapter summarizes the key findings of the research and concludes with

a discussion of the limitations, as well as implications for future research.

CHAPTER II LITERATURE REVIEW

Different from the ways private spaces are accessed, ruled, or owned, the public space has been the complement of this duality through which societies organize themselves around the public-private distinction (Madanipour, 2003). Public space can be considered as the manifestation of human social needs. This chapter begins with the concepts, attributes, typologies, and quality of public spaces. The second section introduces the concept of well-being and its measures. The ways through which public spaces contribute to the physical, mental, and social well-being of their users are unfolded in section III. Moreover, trending theories will be introduced. Lastly, this chapter explores the literature in the past decade as well as the most contributing and influential references to discover their groundbreaking findings as well as suggestions for future research.

I searched for various aspects of well-being (e.g., physical, mental, social, and financial) to utilize the most pertaining ones in my study. Researchers adopt certain aspects of well-being depending on the field of the study. Not only does well-being have various aspects (e.g., physical, mental, social, and financial well-being), but multiple factors contribute to it (e.g., age, genetics, lifestyle, income, gender, and characteristics of one's environment) (CDC., 2018). To select the concept and measures of well-being that suited the purpose of this research, I explored the literature that covered multiple aspects of well-being and green space usage contribution to them. For instance, Larson et al. (2016) utilized the Gallup-

Healthways Well-being Index (WBI) (The most comprehensive measure of well-being in the world) to examine the relationship between park usage and overall well-being. The measures included physical, social, community, financial, and purpose well-being. According to the existing literature, three aspects of well-being are mainly used in the urban planning field for evaluating the contribution of green spaces to community well-being: (1) physical, (2) mental, and (3) social well-being. I used the aforementioned aspects of well-being for my research. Furthermore, well-being measures were adopted from the explored literature as well as various questionnaires (e.g., BMI, having high blood pressure, having anxiety or depression, having social support).

This chapter concludes with a thematic summary of the empirical and experimental studies in the U.S. from 2012 to 2022. The ways that people use public (green) spaces vary across geographies and cultures; hence, exploring the literature in the U.S. context provides a more meaningful understanding of Americans' attitudes toward green spaces. A search for empirical studies in the U.S. was done to explore the literature on the contribution of public parks/green spaces and well-being. Two databases (the EBSCO Web, and Google Scholar) were used. I limited the search to peer-reviewed English articles between 01/01/2012 and 12/30/2022 in American cities. I explored 991 documents in Google Scholar and 644 results in EBSCO-Web databases, eliminated the duplicate articles, books, and non-empirical studies, and limited the research geography. Finally, I reviewed 32 empirical and experimental studies in the U.S. that investigated the relationship between parks, green spaces, greenness, and well-being[1]. After reviewing empirical studies, I

[1] - Search keywords included ("URBAN parks" OR "PLAZAS" OR "PUBLIC spaces") AND ("WELL-being" OR "HEALTH" OR "PUBLIC health" OR "URBAN health" OR "QUALITY of life" OR

checked the references in each paper from 2012 to investigate more available empirical studies.

I Public Space: The Concept, Attributes, Typologies, and Quality

Public spaces, from their most ancient instances in the Mesopotamian civilization to Greek agoras, Roman forums, middle eastern squares (Maidans), and bazaars have provided the ground for people's attendance and participation in social life regardless of their scale and geography (Madanipour, 2003). Cities owe their vitality to public spaces where people find the opportunity to practice social life. Public spaces have embraced and contained public life for centuries, regardless of alterations in definitions, functions, and appearance. Streets, public squares, parks, and plazas are the best instances of social gathering spaces that have maintained their importance throughout history. They serve as essential elements of urban planning/design and provide the opportunity to mingle and socialize more than any other urban place.

Publicness is a crucial theme in defining public space, and there is an ongoing debate regarding the accessibility of public space and its publicness. This characteristic of the public space is "conditional and contingent" and depends on the users' age, gender, status, and the visit/use time (Heffernan, 2014). One or all mentioned conditions can facilitate or impede one's access to the public space. The contingency of public space is based on its users, owners, and managers, which leads to an unsteady definition of 'the public.' Accordingly, considering one's access (or degrees of access) to the public space is at the center of attention when scholars tend to assess the publicness of a space. Ownership

"PSYCHOLOGICAL well-being" OR "SUBJECTIVE well-being (Psychology)" OR "HAPPINESS" OR "WEALTH" OR "RELATIONSHIP quality").

and management are the significant components for assessing the accessibility and actual publicness of a space (Nemeth, 2011). Public space and its publicness are contextual and heterogeneous contents and fluctuate depending on the context of the study (Smith, 2006). For instance, the Western connotation of public spaces derives from the middle-class public-private division and "idle use in contrast to vendors' or beggars' perception who live off the public space" (Bodnar, 2015, p. 2097). Yet, in the Southern countries, public spaces and street life are the "extensions of domestic space and the overflow of private lives into them" (Ibid, p. 2098).

Public space consists of a range of social locations encompassing various domains, including the measurement of daily life, public opinion, global institutions, and economies (Smith, 2006). Nonetheless, the physicality of public space provides a container for social and political actions and struggles, and it is necessary to consider the materiality of the public space in the planning profession. This quality is absent from the "vacuous space of the electronic frontier or the controlled pseudo-public spaces of the malls" (Mitchell, 1995, p. 125). The public space is associated with the material space, where political practice and struggle can create a public realm. Hannah Arendt, Seyla Benhabib, and Jurgen Habermas consider the public realm based on its political connotation and conceptualization of urban spaces (Madanipour, 2003, p. 3). Lefebvre's urban public space serves the everyday practices of life, where various day-to-day activities occur (e.g., streets, parks, and malls). He considers the physicality of the public space as a significant feature that embraces a spectrum encompassing spatial practices of everyday life to protest and violence (McCann, 1999). The public space serves as a platform for people to connect and contact. It improves togetherness without jeopardizing one's anonymity or willingness to stay intimate. Table

2.1 summarizes the main attributes of public spaces.

Table 2.1: Attributes of Public Spaces

Public Space Attributes	Explanations
Ownership	- A publicly owned physical space (not malls, bars, restaurants, …)
Accessibility	- Accessible to all citizens regardless of their age, gender, race, socioeconomic status, and physical/mental disabilities - Lacking gates or walls that can be closed at certain times. The exception applies when all citizens are prohibited from leaving their dwellings (e.g., mandatory lockdown) - Well-distributed and accessible by various transportation means (e.g., personal vehicle, public transportation, bike, scooter, wheelchair, and feet). - Lacking physical barriers that limit the access of certain groups of people. For instance, lack or ramps, or presence of damaged pavements that would discourage vulnerable citizens from attending the public space.
Safety and Security	- Presence of natural or police surveillance that promotes citizens' sense of safety in public spaces. - Well-lit spaces that contribute to attendees' safety and willingness to use the space.
Urban Furniture and Natural Feature	- Benches, restrooms, and trash bins - Presence of greeneries and water features

Table 2.2 illustrates the typology of public spaces from the sociocultural and political-economy perspectives (Carmona, 2010 b) and their functionality (Carr, 1992). Public space is a fluid concept, but its classification facilitates research about various attributes that affect its users, management, form, and function. For instance, studies on the sociocultural perspective of public space focus on its users, their perception, and

engagement with the space. Accordingly, there are various ways that urban scholars classify public space clientele. Users can create marginalized spaces that are landscapes of deviance and deprivation or colored spaces where immigrants and minorities are the major clientele of the space (Carmona, 2010 b). Users can form everyday places of meaning or places of retreat that reflect the ways people interact with one another or experience it alone (Dines, 2006).

Ownership and management of public space creates another classification of these spaces where they define the power relationships in the space and how the public space is produced by differentiating its publicity and privacy. Kilian argues that these power relationships are inseparable elements of all spaces. Publicity is the power to gain access, and privacy is the power to exclude (Kilian, 1997). A classic example of the political-economy space is the public sphere, which is predominantly associated with Habermas. It consists of "private people gathered together as a public and articulating the needs of society with their state" (Team M. T., 2014, p. 42). Habermas introduces a spatially undifferentiated and universal public sphere as the essential component of a critical democracy. The success of a public sphere depends on factors such as; "the extent of access (as close to universal as possible), the degree of citizens' autonomy (the citizens must be free of coercion), the rejection of hierarchy (so that each might participate on an equal footing), the rule of law, and the quality of participation" (Rutherford, 2000, pp. 18-19; Soules, 2007). The implication of the public sphere is associated with the amount of power it has on the state through its authority in everyday discussions and formal elections; hence, it is the sine qua non for the mediation between the state and society. It "permits democratic control of state activities and the need for clear and publicly accessible records of state-

related legal actions" (Team M. T., 2014, p. 42).

The functional perspective of public space considers the material or physical spaces where a wide range of activities occurs. Physical spaces such as streets and public parks - that can be a part of citizens' everyday life- or squares and plazas that host political acts (e.g., protests) are instances of functional public space (Carmona, 2010 b).

Table 2.2: Typologies of Public Spaces

Categories	Typologies of Public Spaces
The Sociocultural Perspective	- Everyday space - Place of meaning - Social environment - Place of retreat - Negative space
The Political-economy Perspective	- Public property (owned by the governments) - Semiotic space (allow competition and segregation in the urban space) - Public sphere (a platform for citizens' social and political interaction)
Functions of Public Space	- Public parks - Squares and plazas - Memorials - Markets - Streets - Playgrounds - Community open spaces - Greenways and parkways - Atrium and indoor marketplaces - Found spaces or everyday spaces - Waterfronts

Assessing the Quality of Public Space: Accessibility

The quality of public spaces is an important criterion to invite urban residents to more usage. The mere existence of a publicly owned physical space does not guarantee citizens' usage and presence in the space. A public space must possess specific qualities to

encourage users' presence and visit. Proximity to these spaces, accessibility, and quality are significant factors in increasing the frequency of visits and encouraging physical activity (Coombes, 2010; Knobel, 2021; Kim G. a., 2019). Quality public spaces should be comfortable and serve as hubs for socializing (PPS, 2021; Mehta, 2014). According to Francis et al. (2012), the quality of public open spaces (POS) is substantial in improving residents' mental health. Residents with higher-quality POSs show to have better mental health than those with lower-quality POS. Moreover, people who visit neighborhood parks daily possess a better perceived health status (Enssle, 2020). From enabling citizens to engage in political and democratic activities to providing safe places for passive recreation (e.g., attending the public space without interacting with others), quality public spaces should possess standards such as universal inclusiveness, accessibility, diversity, flexibility, permeability, meaningfulness, responsiveness, pleasurability, and safety (Nemeth, 2011). Their safety should be achieved by natural surveillance -a product of citizens' constant presence (Mehta, 2014; Heffernan, 2014). The next section discusses how the quality of public space is assessed.

Accessibility is a major factor in assessing the quality of a public space/park. Visual and physical access to parks and green spaces enhances public health and prolongs people's presence and physical activity (Dannenberg, 2003; Lowe, 2014). Physical accessibility of an urban park is measured by 1) the distance from one's residence to a park, 2) the subjective distance (how long it takes for a person to get to a park), 3) visual access (e.g., clear entrance), 4) the number of barriers to access the place, 5) the operating hours of public space and 6) the percentage of people living in a community with access to a public park (Ayala-Azcárraga, 2019; Ramlee, 2018; Villanueva, 2015; Lee A. C., 2015; Cilliers,

2015). The Center for Disease Control and Prevention (CDC) uses a half-a-mile distance to a park and the percentage of the people living within this distance in the *community design* content to measure park accessibility (CDC, 2015). Having access to a park or public space indicates that the place is well-located within a neighborhood, and people can get to the park easily on foot, by bike, on public transportation, or car (Ramlee, 2018).

Distance to urban parks contributes to the frequency of use and duration of staying in the green space. While the shorter distance contributes to more visits, a longer distance to the park might encourage people to stay longer once they get there (Kim G. a., 2019). Moreover, blood pressure is likely to increase by 9% for every 300 meters increase in distance to green spaces for pregnant women (Grazuleviciene, 2014). The risk of cardiovascular disease decreases among residents whose neighborhoods possess more than 15% available green space coverage compared with the residents with the least amount of available green space (Richardson E. A., 2013).

Assessing the Quality of Public Space: Inclusiveness

Successful public spaces should provide an environment for communities to participate in social life and engage in collective actions. The inclusiveness of public space is assessed through the presence of people of different ages, genders, socio-economic statuses, races, and physical abilities (Mehta, 2014; Lee A. C., 2015). Furthermore, the range of activities allowed in the space contributes to the inclusiveness of the public space by inviting various visitors to use the space either by themselves or with a group of people (Francis J. G.-C., 2012 a; Ramlee, 2018).

Assessing the Quality of Public Space: Safety

Safe public spaces do not solely rely on the presence of security guards or cameras.

Natural surveillance through which people watch ongoing activities and pay attention to others, usually grants a sense of security to users. For instance, Jane Jacobs argued that active and visible public spaces seem safer than their empty and derelict counterparts (Jacobs, 1992). Safety can be measured with the crime rate in the study area, and the perception of safety at different times of day/night (Lee A. C., 2015). Traffic control, appropriate lighting, and good maintenance also contribute to safety (BigdeliRad, 2013; Carmona, 2019). Wall et al. (2012) discovered that lack of safe outdoor recreation space and decreased-park space was associated with higher BMI z-score in both boys and girls.

Assessing the Quality of Public Space: Amenities and Comfort

Comfortable public spaces provide different amenities for their users and encourage further use of the space. Places to sit, mingle, and rest, shelters for hot and cold seasons, facilities for recreational activities (e.g., playgrounds), multi-purpose spaces such as amphitheaters or performance areas, and restrooms are the key contributors to the place's comfort (Mehta, 2014; Lee A. C., 2015; Carmona, 2019; Ayala-Azcárraga, 2019). Moreover, natural elements (e.g., trees, plants, grass, and bodies of water) significantly improve the quality of public space (Carmona, 2019). The recreation facilities (walking/biking trails and gym), as well as the proportion of land use for such nearby facilities, are prominent components for assessing the quality of green space (Richardson E. A., 2013). Young et al. (2014) discovered that participants in their study ranked parks as the first benchmark for physical activity and second in the physically active friendly community (PAFC).

The public space in this research is a publicly owned physical space that is always accessible to all. Hence, malls, cafes, theaters, and restaurants are not examples of public

spaces. The publicity, accessibility, design features, amenities, safety, and security are the main attributes that will be studied to investigate the public space's contribution to community well-being.

Assessing the Quantity of Green Space: Exposure

Researchers implement various measures to assess individuals' access or exposure to green spaces. The Normalized Difference Vegetation Index (NDVI) (Almanza, 2012; Cohen-Cline, 2015; Riggs, 2021) or an overall concentration of nature index (Li, 2018) is used to assess the amount of green space surrounding participants' homes. The proximity to green spaces is measured by defining buffers from participants' residences to parks (Sturm, 2014) or the time people spend getting to green spaces by walking or driving (Baur, 2013). Table 2.3 shows green space exposure measurement across studies.

Table 2.3: Green Space Exposure Measures

Green Space Exposure Type	Studies
Normalized Difference Vegetation Index[1]	Almanza et al. (2012); Riggs et al. (2021); Cohen-Cline et al. (2015); Pun et al. (2018); Yeager et al., (2020); Yeager et al. (2018); Youna et al. (2016)
Overall concentration of nature index	Li et al. (2018)
Distance from green spaces (e.g., accessible from roads within ½ mile of the participant's home, or residential locations within 400m, 800m, 1.6 km, and 3.2 km	Epstein et al. (2012); Sturm et al. (2014); Wall et al. (2012); White et al. (2021); Miles et al. (2012); Kim et al. (2014)
Time spent to access a green space (walking or driving)	Baur et al. (2013)
On-site surveys and interviews	Hadavi (2017); Yuen et al. (2020); Kim et al. (2019); Swierad et al. (2018); Svendsen et al. (2016); Burgess et al. (2021); Grima et al. (2020); Maurer et al. (2021); Holt et al. (2019)
Length of exposure to green space (varying from 20 to 90 minutes across studies)	Beil et al. (2013); Berman et al. (2012); Bratman et al. (2015 b); Bratman et al. (2015 a)
Self report of park usage (online survey)	Lopez et al. (2021); Hazer et al. (2018)
Exposure to green space through virtual reality (VR)	Yin et al. (2022)

II Well-being: The Concept and Measures

Health and well-being may be used interchangeably despite the nuances between the two. Life expectancy, causes of death, and morbidity measures can serve as indicators of population health, but well-being is "a dynamic and relative state where one maximizes his or her physical, mental, and social functioning in the context of supportive environments to live a full, satisfying, and productive life" (Kobau, 2010, p. 274). It can

[1] - NDVI cell values represent percent vegetation, and a median or mean value within a distance-based buffer or administrative boundary can be used (ranging from 30 m to 1 km) (Kondo, 2018).

be measured with self-perceived health, longevity, healthy behaviors, mental and physical illness, social connectedness, and productivity (CDC., 2018).

While there is no consensus about a single definition of well-being, the general agreement refers to it as a concept that indicates how individuals perceive that their lives are functioning well. It is associated with one's positive energy (e.g., happiness), the absence of sad feelings (e.g., depression), and life satisfaction (CDC., 2018; CDC, 2020). Individuals' personalities, demographics (e.g., age, gender), genetic factors, lifestyle, education, and economic status (e.g., income, employment) contribute to one's well-being (Kobau, 2010; CDC., 2018). Environmental factors and physical attributes of people's environment, such as climate and geography, also affect well-being. For instance, Brereton et al. (2008) discovered that living close to landfills (e.g., waste facilities) has a negative impact on residents' well-being, or proximity to coasts has a positive effect on well-being. Their study shows that elements such as major transport routes (e.g., freeways) and international airports also influence well-being. The strength of social relationships and connections are other determinants of individual-level subjective well-being (Becchetti, 2009).

There are nine aspects of well-being derived from different disciplines: physical well-being, economic well-being, social well-being, development and activity, emotional well-being, psychological well-being, life satisfaction, domain-specific satisfaction, and engaging activities and work (CDC., 2018). Implementing well-being measures in policies, guidelines, and regulations assists policymakers to improve the overall quality of life in the communities they serve through their related profession (e.g., health, the environment, work and economy, and social life). It helps policymakers by supplying them with the

standard metrics to shape and compare various policies (Diener, 2009). For instance, urban planners, designers, and scholars often study physical, mental, and social aspects of well-being in relation to the built environment and public space. Emotional and psychological well-being, life satisfaction, quality of life, and happiness are treated under the mental well-being category. Table 2.4 illustrates three well-being indicators that are used in urban planning/studies.

Table 2.4: Well-being Indicators

Categories	Indicators
Physical Well-being	- Body Mass Index (BMI) - Perceived health - Having physical disability - Self-reported morbidities (e.g., hypertension, diabetes, hypercholesterolemia, and respiratory illnesses)
Mental/Subjective/Psychological Well-being	- Anxiety - Depression - Stress - Insomnia - Tolerance
Social Well-being	- Isolation/Loneliness - Altruism - Social Cohesion - Social Support

III Public Space and Well-being

One of the downsides of the massive urbanization after the industrial revolution in the late 19th and early 20th century was the fast growth of infectious and contagious diseases in overcrowded slums and densely populated settlements. Yellow fever, bubonic plague, typhoid fever, malaria, tuberculosis, respiratory infections, diphtheria, and smallpox contributed to high mortality and morbidity rates in the U.S. for over two centuries: from the 17th to the 19th century (Duffy, 1971). The importance of public space in the U.S. as a means of alleviating the undesirable conditions of industrial cities and curbing the mortality

rate in urban areas dates to the 19th century, when urban reformers and professionals stated its potential to assist public health, political and social ends (Nemeth, 2011).

Engineering the built environment contributed to public health, before the advent of bacteriology and germ theory, the improvement of medical knowledge, and the invention of vaccines. The miasmatic theory, whose impact on the American urban landscape is evident in this era, convinced laypersons, landscape architects, medical professionals, and sanitarians to provide healthy environments to guarantee residents access to clean water, natural light, and fresh air. The underlying reasoning for adopting this theory was the relationship between the presence of "disease laden-air and certain landforms, climates, animal waste, and animal decomposition that caused the epidemics" (Szczygiel, 2000, p. 708; Duhl, 1999). Open public spaces, especially public parks, received more attention from landscapers and health professionals. Fredrick Law Olmsted and John Henry Rauch's efforts to build and provide urban parks in Chicago are prominent instances of implementing miasmatic theory into design (Szczygiel, 2000). For instance, the sanitary reform that led to the physical transformation of American cities raised the growing scientific understanding of infectious diseases and how cities' growth at that time led to socially intolerable conditions (Peterson, 1979; Gandy, 2006).

Olmsted stated how urban parks could promote public health by functioning like the lungs of the city. He argued that the built environment needed attention due to the relationship between "mental hygiene" and congestion. He reasoned that "congestion depleted nervous energies, and believed that spacious, restful parks and low-density neighborhoods counteract this deprivation" (Peterson, 1979, pp. 92-93). Moreover, he argued that urban parks could compensate for the detrimental effects of urban life.

Promoting democratic values, social life, mental health, social cohesion, and building the capacity for equality are the main benefits of urban park systems (Eisenman, 2013). In another case, John Nolan advocated for parks to increase the morality and civility of humans (Nemeth, 2011), and Rauch -as a physician- focused on transforming Chicago's cemetery into a public park to save the city from the miasmatic situation. For Rauch, the benefits of an extensive urban park system were not limited to their undeniable impacts on public health, provision of fresh air, and promoting the city's microclimate. Public parks, he claimed, are the "important educational tool for Chicago's residents" (Szczygiel, 2000, pp. 21-24, 28).

In the 20th century, zoning played a significant role in forming American cities to promote public health by separating hazardous and congestion-generating land uses from housing (Schilling, 2005). But the provision of public space does not appear to be a significant concern in zoning ordinances of this time. Treating urban land as a commodity since the 1970s, which led to the privatization of public spaces, has affected their availability and quality (Corburn, 2007). The asymmetrical public health activities and the growing inequality across different population groups in the 1990s have made some nations reconsider how they explain disease distribution, examine health disparities across various populations, and focus on social epidemiology. Social epidemiology concentrates on how social and economic inequalities become biologically embedded in some population groups and geographies. The current public health trend reflects the biomedical model and individual risk disease factors. But social epidemiology focuses on enhancing public health through neighborhood improvement, poverty elimination, and social health resource provision (Corburn, 2007).

The research about the potential of public space to promote healthy cities has augmented in the 21st century when urban residents suffer from sedentary lifestyle diseases (e.g., chronic respiratory diseases, obesity, and diabetes). Although the causal relationship between the physical environment and individuals' health is difficult to establish, empirical studies indicate that the features and mechanisms of the material space improve public health (Rao, 2007). The health-promotive environments reduce noise, pollution, and other sources of stress and disturbance, remove environmental barriers that restrict physical activities, and alleviate the current urban health issues, such as inactive, age-related, and non-communicable diseases (Rao, 2007; Sarkar, 2017; Lowe, 2014; Frank, 2001). Suitable public spaces can buffer negative stressors and contribute to urban residents' mental well-being (Park G. a., 2016).

The efforts to promote community well-being through improving the built environment and considering the WHO definition of health[1] manifest in the healthy city's vision, where "an accessible social, physical and cultural environment that facilitates the pursuit of health and well-being" (Organization, 2022). In this regard, public spaces have proved to be a significant element of healthy cities. The following sections discuss how parks (as green public spaces) contribute to the physical, mental, and social well-being of citizens.

Parks and Physical Well-being

Physical inactivity is associated with the 21st-century modern lifestyle, when the

[1] - According to the Constitution of the World Health Organization, health is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (Organization, Basic Documents, 2020).

use of personal vehicles, long commuting hours between home and work, air pollution, lack of spaces for exercise, increased sedentary workstyle (e.g., growth of office work), spending an unprecedented amount of time watching TV, or using personal computers contribute to inactivity (Park J. H., 2020). But in the long term, physical inactivity leads to destructive health issues. According to the CDC, about one in two adults and 77% of high school students in the United States do not participate in aerobic physical activity, which causes three significant harmful impacts of physical inactivity, including heart disease, type II diabetes, and cancer and results in $117 billion in annual healthcare costs related to physical inactivity (NCCDPHP, 2022).

Even people without heart disease risk factors can develop heart disease if they have a sedentary life. Physical inactivity can contribute to other factors that increase the risk of heart diseases (e.g., obesity, hypertension, hypercholesteremia, and type II diabetes) (NCCDPHP, 2022). While physical activity controls blood sugar, weight, blood pressure, and cholesterol, physical inactivity can increase the risk of type II diabetes by increasing the risk of heart disease and nerve damage -problems that diabetics deal with. According to the CDC, an active lifestyle can decrease the risk of various cancers (e.g., breast, colon, and uterus) (NCCDPHP, 2022; Park J. H., 2020). Nonetheless, the literature suggests that "behaviors are influenced at multiple levels, including biological, psychological, social/cultural, physical environment, and policy levels" (Koohsari, 2013, p. 295). Accordingly, the need for constructing health-promotive environments has become a necessity to facilitate physical activity.

There is plenty of empirical evidence revealing the positive impacts of parks on physical well-being by promoting physical activity, which in turn, reduces the risks of

cardiovascular diseases (CVD) (Modesto, 2021; Richardson E. A., 2013; Kling, 2018), reduces the body mass index (BMI) (Epstein, 2012; Kim J. L., 2014; Kling, 2018), and lowers the systolic blood pressure (Modesto, 2021). Exposure to green spaces is beneficial to all age groups. Access and proximity to parks are positively associated with a higher frequency of children's physical activity as well as less time spent watching TV and other electronic devices; therefore, improving their health (Akpinar, 2017; Almanza, 2012). Bozkurt (2021) echoes these findings and suggests that children visiting urban parks for physical activities are less likely to be overweight or have obesity risk. Moreover, spending less than 5 hours per week in the park is proven to be associated with poor health in 14% of 3,416 children aged 4-6 years who were studied by Grazuleviciene et al. (2014).

Park-based physical activity contributes to cardiovascular health in multiple ways. A park-based physical activity intervention in Sao Paulo, Brazil, showed a significant increase in cardiorespiratory fitness as well as a decrease in body mass index, waist circumference, and systolic blood pressure, which help decrease global cardiovascular risk (Modesto, 2021). The amount of green space coverage in neighborhoods also plays a significant role in reducing residents' risk of cardiovascular disease. Seo (2019) studied seven Korean metropolitan areas and discovered that participants living in the areas with most green space coverage had reduced risk of total cardiovascular and coronary heart disease, acute myocardial infarction, total stroke, and ischemic stroke, and no hemorrhagic stroke when compared with the residents with the least green spaces environments.

According to Khan et al. (2018), obesity is associated with "shorter longevity and significantly increased risk of cardiovascular morbidity and mortality compared with normal BMI" (p. 280). The concern rises by looking at the obesity rate in the United States.

According to the CDC, in 2021, 32.3% of male American adults were obese, as well as 33.7% of women (CDC., 2023). One preventive solution to combat obesity prevalence and its consequent cardiovascular disease risk is to consider the spatial patterns of public parks in urban areas. A 2-year follow-up and an observational study of 8-12-year-old children in Erie County, New York, including 191 families, indicated that parklands and active recreational spaces with parkland (accessible from roads within ½ mile of the participant's home) were associated with weight control across different types of treatment programs in the long term. More tree patches, well-connected landscape patterns, and larger sizes of urban forests -in the half-mile airline buffer- have a negative correlation with children's BMI z-scores even after controlling for the socioeconomic status of green space users (Kim J. L., 2014).

Urban parks also improve the cardiovascular system by reducing air pollution, enhancing mental capacities such as stress recovery and anxiety reduction, or encouraging physical activity. Yeager et al. (2018) and Riggs et al. (2021) suggested that residential greenness is associated with lower levels of sympathetic activation, reduced oxidative stress, higher angiogenic capacity, and better vascular function. The findings of both studies are independent of age, sex, race, smoking status, neighborhood deprivation, statin use, and roadway exposure (e.g., proximity to busy roads and highways). They claim that the positive impact of green spaces on the vascular system is due to their impact on reducing the effects of ambient air pollution (Riggs, 2021). Another benefit of greenness is that they refine the ambient air by reducing harmful vapors such as volatile organic

compounds (VOCs)[1]. Yeager et al. (2021) discovered that urban residents living in areas with more green spaces "experience significantly lower exposure to harmful VOCs than residents of low greenness areas do, even after adjustment for sex, race, age, roadway proximity, and population density" (p. 12).

Parks and Mental Well-being

According to the Center for Urban Design and Mental Health, "Good mental health involves our basic cognitive and social skills, our ability to empathize, recognize, express and modulate our emotions, to cope with challenges and to enjoy life" (Health, 2022). Urban life, regardless of its numerous benefits, can contribute to mental problems such as the increase in anxiety and mood disorders, double risks of schizophrenia, and higher rates of cocaine and heroin addiction associated with urban living (Peen, 2010). However, empirical studies indicate a correlation between exposure to green spaces and mental well-being that can be considered in the urban planning process as well as decision-making. Abdul Aziz et al. (2021), discovered that a 20-minute walk in a green space increases positive emotion and decreases mood disturbance compared to the control group who had a 20-minuute walk in the city center with no green space. The pre-post assessment surveys also validate the hypothesis that a short-term visit to urban parks leads to positive changes in users' affect and life satisfaction. These positive changes are associated with the amount of time spent in the park (Yuen, 2020).

Public green spaces, public parks, green infrastructure, and public open spaces prove to enhance their users' mental well-being. Public parks function as places for

[1] - VOC vapors can cause various health effects, including eye, nose, and throat irritation; headaches and loss of coordination; nausea; and damage to the liver, kidneys, or central nervous system (Agency, 2022).

relaxation, leisure, and stress reduction; therefore, positively impact citizens' mental health. Safe public spaces that are self-policed and naturally surveilled by the presence of diverse citizens allow children to attend, play, learn, and establish their cognitive map and boost their psychological health in a place where strangers are not a source of fear but rather a reminiscent of other ways of being (Mehta, 2014; Nasution, 2012; Valentine, 1996). Public parks can become therapeutic spaces where residents of dense and populated urban neighborhoods can take refuge. They help people connect with themselves, reduce the stress of busy urban life, and manage their thoughts (White, 2021; Swierad, 2018). For instance, the inferential statistics of 100 surveys in a study conducted by Kim and Miller (2019) determined that using green infrastructures lowers users' anxiety, helps people to ponder and reflect, contributes to their sense of community pride, and made people more caring.

Urban parks assist their users in connecting with their acquaintances (e.g., family and friends), getting in touch with their neighbors and community, providing them spaces to ponder and have personal moments, and connecting with nature (Swierad, 2018). Studies show the importance of public parks in improving people's mental well-being during the COVID-19 pandemic. It appears that people's perception and use of urban parks altered to become "extremely important" places for psychological and physical health (Lopez, 2021), acquiring peace, a quiet area, connecting to nature, or participating in activities to reduce stress and rumination (Grima, 2020).

Even though measuring mental well-being is a complicated task and its subjectivity makes it difficult to be assessed, it can be measured by reported rates of certain mental illnesses, proxy measures (e.g., suicide rates), self-reported measures of low mood, stress,

anxiety level, or happiness. Nonetheless, the latter cannot be considered as a proxy for mental illness, but some studies use it as mental well-being description (Health, 2022). Studies that explore the relationship between greenness and mental well-being have assessed health outcome measures such as individuals' cognition (e.g., working memory capacity, verbal working memory, visuospatial working memory, and executive attention), affect (e.g., mood, anxiety, rumination, negative, and positive affect) (Bratman G. N., 2015 b; Cohen-Cline, 2015; Li, 2018; Berman M. G., 2012); depressive symptoms (Miles, 2012; Pun, 2018); salivary cortisol samples, subjective stress scale, and perceived stress scale (Beil, 2013; Hazer, 2018); aggressive behavior (Younan, 2016); Attentional Functioning Index (Hadavi, 2017); subjective well-being (Yuen, 2020). The measures of mental well-being are interrelated, and researchers tend to focus on multiple measures. For instance, Berman et al. (2012) studied the impact of greenness exposure on cognition and affect, and Pun et al. (2018) examined the association of neighborhood greenness with self-perceived stress, depression, and anxiety symptoms in older U.S. adults.

Most studies investigate the association between greenness and mental, subjective, or psychological well-being by using standard questionnaires (e.g., Mental Health Inventroy-5, GHQ-12, or SF-36) or measuring all indicators that contribute to mental well-being (e.g., depression, stress, anxiety, depressed mood, tiredness, and lack of ability to experience pleasure). Regardless of the assessment methods, the amount of greenness in urban neighborhoods, exposure to green spaces, and the distance to parks are positively associated with mental well-being. Various radii are used to evaluate the accessibility of urban parks, including 400m, 800m, 1.6 km, and 3.2 km. For instance, according to Strum et al. (2014), residents with the shortest walking distance from a park (400m) had the

highest MHI-5 score, and it decreases significantly as the distance from the park increases. Cohen-Cline et al. (2015) and White et al. (2021) studies on a 1000-m buffer from park users' homes also validate the importance of accessibility to green spaces within walking distance. When controlling for socioeconomic confounders, residents of greener urban neighborhoods who visit parks more frequently show less mental distress.

The studies indicating the association between greenness exposure and anxiety conclude differently. For instance, Cohen-Cline et al. (2015) state that their findings provide less evidence for the effects of access to green space on stress or anxiety. White et al. (2021) mention that their results confirm the positive association between more exposure to greenness and less use of doctor-prescribed depression medication (not anxiety). Green space exposure did not lead to stronger positive impacts on stress recovery than the desert or office area according to Yin et al. (2022). Interestingly, they discovered that exposure to the desert had a similar stress recovery impact as the green environment in terms of stress recovery, and the recovery "of cortisol in the first 40 min after an acute stressor was enhanced by desert or green exposure compared to an office exposure" (Yin, 2022, p. 7). This study was conducted in a desert setting, and the authors suggest that participants' familiarity with the desert landscape and their lived experiences in this setting might explain the significant reductions in salivary cortisol and mean arterial pressure compared to participants in the office -the control condition.

Regardless of mixed results about the contribution of green space exposure to stress, Hazer et al. (2015) found that the amount of time spent accessing green spaces (physically and visually) was "statistically significant in predicting perceived stress, after controlling for stressful life events, demographics, housing type, exercise, and hours of green space

time due to socializing" (p. 55). Beil et al. (2013) also found a statistically significant subjective stress difference between the very natural and mostly built settings in their study, which suggests a potential environmental contribution to the moderation of stress. They discovered that gender was a determinant of different responses to environmental settings. Women showed a greater decrease in subjective stress than men after their exposure to the very natural setting. Levels of physical activity in parks have different impacts on people's health and those with low physical activity levels tend to have a higher stress level (Moreira, 2013). Urban green spaces also play a significant role in deprived urban neighborhoods. According to Roe et al. (2013), more green spaces in disadvantaged urban neighborhoods with non-working middle-aged men and women are linked with lower perceived stress and a healthier diurnal cortisol[1] decline.

Parks and other urban green areas have psycho-social-spiritual benefits, where people use them for spiritual reasons to connect with themselves and the larger reality through unity with nature, spirituality, religion, and memorialization (Svendsen, 2016). People perceive parks as para-urban spaces[2] that promote their subjective well-being (Maurer, 2021). Promoting the quality of life and higher levels of happiness; due to more frequent and active engagement with green spaces are other benefits of public green spaces (Holt, 2019). Experimental studies prove the importance of exposure to green spaces. According to Berman et al. (2012), a mood evaluation before and after a walk in a natural

[1] - Cortisol is sometimes called the body's stress hormone. "Cortisol has many functions in the human body, such as mediating the stress response, regulating metabolism, the inflammatory response, and immune function" (Thau, 2022).

[2] - "The para-urban space refers to the ways the park was described by participants as a space that existed alongside, but distinct from, the urban milieu around it" (Maurer, 2021, p. 6).

or an urban environment indicates an increase in participants' mood after visiting the natural urban environment. Other experimental studies validate Berman's findings by discovering significant associations between the concentration of nature and daily mood in participating adolescents, as well as more benefits from the natural walk than the urban walk in terms of decreased anxiety, rumination, and affect[1] (Bratman G. N., 2015 b; Li, 2018). The associations remain significant even after controlling for intra-individual and inter-individual level confounding variables and do not change by demographic or socio-economic background (Li, 2018).

Assessing cognitive function is another theme that reveals the benefits of green spaces in urban areas. The experiments assess and compare different measures of cognition (e.g., verbal working memory, visuospatial working memory, and executive attention) after nature and urban walks (Bratman G. N., 2015 b; Berman M. G., 2012). Exposure to greenness results in increased verbal working memory (Bratman G. N., 2015 b), a significant increase in people's memory span, and great improvement in their working-memory capacity (Berman M. G., 2012). Moreover, using green spaces enhances the symptoms of attention deficit disorder (ADD) and decreases pain (Wang, 2020). A nature walk in urban settings decreases self-reported rumination[2] and neural activity in the subgenual prefrontal, while a 90-minute walk did not have such effects (Bratman G. N., 2015 a). Furthermore, there is strong evidence supporting the positive impacts of neighborhood green spaces in reducing aggressive behaviors (physical and verbal

[1] - Measures for affect include anxiety, rumination, and positive and negative affect (Bratman G. N., 2015 b).

[2] - Rumination is "a maladaptive pattern of self-referential thought that is associated with heightened risk for depression and other mental illnesses" (Bratman G. N., 2015 a, p. 8567).

aggression) among youth (Younan, 2016).

The epidemiological evidence regarding the association between green space and depressive symptoms is not consistent. Even though findings suggest that contact with nature contributes to mental health, Miles et al. (2012) discovered that the association between living in a neighborhood with a moderate amount of green space and depressive symptoms did not indicate a statistical significance when compared to those neighborhoods with no green space. While Pun et al. (2018) confirm Miles's results, they uncovered a significant association between neighborhood greenness and having fewer depressive symptoms among white participants with higher socioeconomic status and more physically active lives. The frequency of park visits is negatively associated with mental health distress and taking prescribed depression (though not anxiety) medication (White, 2021).

Parks and Social Well-being

The contribution of green public spaces to the well-being of society is not limited to physical and mental health. They are the realms of social life -where citizens can engage in passive or active participation, provide the context for social diversity, increase residents' tolerance, and sense of belonging, and improve social cohesion (Mehta, 2014; Langegger, 2013). Public spaces encourage people's presence and can effectively influence their behaviors (Honey-Rosés, 2020; Rao, 2007; Sarkar, 2017; Lowe, 2014). They contribute to social capital by providing people a platform to engage in dialogues and interact with other social groups, allowing social interaction that would not happen otherwise (Ijla, 2012). The social interactions that happen in public spaces (e.g., parks) are not formal encounters. They can be in the form of talking with strangers, playing with them, or watching them or children play (Chiesi, 2022). For instance, Burgess et al. (2021)

discovered that Latinas in the greater Los Angeles area use parks as communication hotspots to share information, discuss their ideas, and build social networks. They state that having such communication hotspots reflects positively on people's health-related social capital regarding discussion frequency, network size, and diversity. Urban parks assist users in connecting with their acquaintances (e.g., family and friends), getting in touch with their neighbors and community, providing them spaces to ponder and have personal moments, and connecting with nature (Swierad, 2018).

Public green spaces provide lonely citizens with a place where their isolation can be reduced and help them with their social and mental well-being. Daily visits to neighborhood parks make park users more integrated into social networks (Enssle, 2020). People use parks to enhance their social well-being by building social ties and connecting with others (Svendsen, 2016). Proximity to urban parks, where people conduct social activities, is positively associated with neighborhood social health (Baur, 2013). While park-related social interactions have a significant relationship with people's social health, Baur et al. (2013) discovered that the existence of parks remains significant, and urban nature has a positive effect on people's social health whether they use the parks or not. The research on the relationship between proximity to quality urban parks indicates the significance of provision for accessible, well-distributed, and suitable urban parks.

IV Contribution of Current Research

With the progress in microbiology and germ theory in the public health profession and zoning for separating disease-causing land uses from residential areas, the importance of public spaces declined throughout the 20th century. However, the inactive urban lifestyle in the 21st century and its negative impacts on the population (e.g., obesity, hypertension,

cancer) have shifted attention to public spaces. The commercialization and modification of public spaces in the 20th century also overlooked the contribution of these spaces to citizens' social, political, and healthy life.

There is a growing understanding of the significant association between public green spaces and individuals, physical, mental, and social well-being. The empirical and experimental studies explore the ways through which exposure to green spaces, park-based physical activities, and distance to urban parks improve people's health. The findings of a metanalysis about the health benefits of green space usage provide the following health outcomes: "decreased salivary cortisol, heart rate, diastolic blood pressure, HDL cholesterol, low-frequency heart rate variability (HRV), and increased high-frequency HRV, the incidence of stroke, hypertension, dyslipidemia, asthma, and coronary heart disease, as well as decreased risk of preterm birth, type II diabetes, all-cause mortality, small size for gestational, cardiovascular mortality, and an increased incidence of good self-reported health (Twohig-Bennett, 2018).

According to my literature search about the relationship between park usage and well-being that has been conducted in the U.S. in the past decade (2012 to 2022), both the empirical and experimental studies mainly focus on one or two measures of physical, mental, or social well-being when exploring the relationship. For instance, Wall et al. (2012), Kim et al. (2019), and Epstein et al. (2012) only focus on the contribution of greenness exposure to physical well-being. Strum et al. (2015) and Lopez et al. (2021) concentrate on general mental well-being, while others investigate the impacts of park usage on depression (Miles, 2012; Pun, 2018), mood, and affect (Berman M. G., 2012; Li, 2018), or other mental well-being aspects (e.g., cognition, aggression, or rumination).

Some studies explore the social advantages of frequent park usage (Baur, 2013; Maurer, 2021). Table 2.5 illustrates a thematic summary of the distribution of research on each well-being measure empirical and experimental studies in the U.S. from 2012 to 2022. The current research establishes a comprehensive assessment of the relationship between park usage and physical, mental, and social well-being and assesses the cumulative impact of green space usage on well-being, which is discussed in the next chapter. Not only does this research inquiries about park users' physical health (e.g., perceived health) and health outcomes (e.g., high blood pressure and cholesterol, diabetes, and respiratory illnesses), but it also surveys respondents' mental state (e.g., depression, nervousness, tiredness, and calmness) and social well-being (e.g., attending the park to be around others).

In addition, this dissertation does not address a certain population as most studies do (e.g., selecting respondents from a specific age cohort, gender, race, or ethnicity). The surveys will be distributed in three census tracts (51, 52, and 66), and every household will have the opportunity to take part in this study. According to the literature, studies usually consider the tree canopy (Almanza, 2012; Younan, 2016) or the distance from one's residence to a green space (Kim G. a., 2019; Wall, 2012) to assess the association between greenness and well-being.

Despite the growing urban population and the importance of parks in promoting healthy cities, the number of empirical studies about the relationship between urban green space usage (e.g., parks) and well-being is rather limited in the U.S. context. There is no doubt that there are core concepts that can be adopted from international studies. Some of these studies can provide policy implications for planning (e.g., accessibility, distribution, and quality of parks). However, the cultural, environmental, and other contextual

differences require more and closer attention to dense neighborhoods in American cities. There is a need for more indigenous and contextual studies that focus on the car-oriented, individualistic, and suburban nation in order to justify investments in park promotion, land allocation to public spaces, and provision of green infrastructure in dense urban neighborhoods.

Finally, Louisville is envisioned to be a healthy city by 2040, in 17 years- according to its comprehensive plan. However, only %37.9 of its residents live within 10 minutes of a park (Dashboard, n.d.). This study is conducted at the heart of the dense and populated Old Louisville to provide insight into the relationship between park usage and the physical, mental, and social well-being of Old Louisville residents. The findings can have contextual policy and planning implications for city redevelopment to meet one of the urban determinants of health: “ensuring access-to-all green spaces, areas for social interaction and good facilities are available for all” (WHO, 2020).

Table 2.5: Thematic Summary of the Empirical and Experimental Studies in the U.S. from 2012 to 2022[1]

Well-being	Type of Study	Citation	Sample Size	Location	Population
Physical Well-being	Cardiovascular Diseases	Yeager et al. (2018)	408	Louisville, KY.	The outpatient cardiology clinic of the University of Louisville
		Riggs et al. (2021)	73	Louisville, KY.	Patients with They had moderate-to-high CVD risk (e.g., hypertension, hypercholesterolemia, obesity, diabetes)
		Yeager et al. (2020)	213	Louisville, KY.	Non-smoking individuals
	Obesity	Epstein et al. (2012)	191	Erie County, New York	8-12-year-old children
		Wall et al. (2012)	2,682	Minneapolis/St. Paul MN	Adolescents from 20 schools
		Kim et al. (2014)	61	Inner-city neighborhoods in Houston, TX	Fourth- and fifth-grade Hispanic children
	Physical Activity	Almanza et al. (2012)	208	A smart-growth community in Chino, California (The Preserve)	8-14 years old
		Strum et al. (2014)	1070	Los Angeles, CA.	
		Young et al. (2014)	33	USA	Youth aged 10–14 years
		Cohen-Cline et al. (2015)	4,338	District of Columbia and all 50 states except Alaska, Delaware, Hawaii, and Vermont	Same-sex adult twin pairs
		Kim et al. (2019)	100	Blacksburg, Virginia	Adults

[1] - There are some studies that explore two or more measures of well-being. For instance, Pun et al. (2018) studied depression and anxiety. Therefore, some studies are repeated in the table under two different aspects for measuring mental well-being. I have used (Kondo, 2018) framework in categorizing the type of studies.

Table 2.5: Thematic Summary of the Empirical and Experimental Studies in the U.S. from 2012 to 2022 (Cont.)

Mental Well-being	General Mental Well-being	Strum et a. (2014)		Los Angeles, CA	
		Cohen-Cline et al. (2015)	4,338	District of Columbia and all 50 states except Alaska, Delaware, Hawaii, and Vermont	Same-sex adult twin pairs
		Hadavi (2017)	434	Chicago	
		Swierad et al. (2018)	20	New York City	Culturally diverse residents
		Kim et al. (2019)	100	Blacksburg, Virginia	Adults
		Yuen et al. (2020)	94	Mountain Brook, Birmingham, Alabama	Park visitors
		Grima et al. (2020)	346	Burlington, Vermont	
		Lopez et al. (2021)	1,372	New York City, NY.	People (>18)
		White et al. (2021)	16,307	International, CA.	
	Cognition	Berman et al. (2012)	19	The greater Ann Arbor Area, Michigan	People with major depressive disorder (MDD)
		Bratman et al. (2015)	60	Stanford area, California	
	Mood and Affect	Berman et al. (2012)	19	the greater Ann Arbor Area, Michigan	People with major depressive disorder (MDD)
		Bratman et al. (2015)	60	Stanford area, California	
		Li et al. (2018)	155	Central Illinois	Adolescents
	Depression	Miles et al. (2012)	1,980	Miami, Florida	Adults

Table 2.5: Thematic Summary of the Empirical and Experimental Studies in the U.S. from 2012 to 2022 (Cont.)

Mental Well-being (Cont.)	Depression	Pun et al. (2018)	4118	National level	Community-dwelling older adults aged 57–85 years
	Stress/Anxiety	Beil et al. (2013)	15	USA	Adults
		Cohen-Cline et al. (2015)	4,338	District of Columbia and all 50 states except Alaska, Delaware, Hawaii, and Vermont	Same-sex adult twin pairs
		Pun et al. (2018)	4118	National level	Community-dwelling older adults aged 57–85 years
		Hazer et al. (2018)	323	Baltimore, Maryland	
		Yin et al. (2022)	95	El Paso, Texas	Healthy adult male residents
	Rumination	Bratman et al. (2015)	38	San Francisco Bay Area, California	Healthy participants
	Aggression	Younan et al. (2016)	1,287	Southern California	Participants of the Risk Factors for Antisocial Behavior Study
	Spiritual well-being	Svendsen et al. (2016)	1,680	New York City, NY.	
	Quality of Life	Holt et al. (2019)	207	A suburban area of the Southeastern USA	Undergraduate students
Social Well-being	Social Support and Community Engagement	Baur et al. (2013)	1000	Portland, OR.	Portland residents
		Svendsen et al. (2016)	1,680	New York City	Park users
		Swierad et al. (2018)	20	New York City	Culturally diverse park users
		Burgess et al. (2021)	780	Greater Los Angeles Area, CA.	Latinas
		Maurer et al. (2021)	105	Lower Manhattan, NY.	Park users

CHAPTER III METHODOLOGY

I Research Questions

The previous chapter signified the association between frequent green space usage and physical, mental, and social well-being. It indicated how exposure to greenness reduces the risk factors contributing to cardiovascular disease by lowering blood pressure and cholesterol (Riggs, 2021), and increasing the opportunities for physical activity, which can reduce BMI (Wall, 2012; Young, 2014). Moreover, frequent park visits alleviate stress and anxiety and contribute to overall mental wellness (Beil, 2013; Cohen-Cline, 2015). Furthermore, regular park usage can promote individuals' social well-being and provide a platform for social connection between community members (Burgess, 2021; Swierad, 2018). The current study uses Central Park in Louisville, KY, to examine these associations in a mid-size city and dense urban neighborhood. It explores three research questions: (1) how do residents use the park? (2) does park usage improve residents' physical and mental health, and (3) does the park contribute to social well-being? The main objective is to examine the associations between frequent park usage and community well-being. To investigate these associations and address the research questions, I have conducted a 100%-household survey in the Old Louisville neighborhood, which is discussed in detail in Chapter IV.

Public spaces function as resources that serve individuals in multiple ways and

levels. Hence, assessing their quality requires researchers to examine the population and their characteristics, the scale, time, and how these spaces operate, which translates to the multiplicity of ways that public spaces can be assessed. The quantity of the collected data (though not compromising the quality) can lead to more comprehensive and detailed results. Such findings that may ultimately have policymaking implications would be more likely to include a wide range of populations. Nonetheless, there are obstacles to collecting data from public space users in a way that represents the entire population. The objective of the research, its scale, time, and financial constraints determine the sampling strategies. However, the body of literature, regardless of its scale (e.g., international, national, regional, or urban level), provides insights for further research by describing the scale and sampling limitations. The following sections provide an overview of multiple scales and sampling strategies, benefits, and challenges.

International Studies and Sampling challenges

Regardless of the scale or field of study the contribution of public spaces to individuals' well-being, the results indicate a positive association between the two (Khotdee, 2012; Ujang, 2015; Sturm, 2014). However, the population studied, the reason for their selection, and the sampling strategies cannot be inclusive and reflective of the whole population. Even though the larger the geographical scale of the research is, the more likely it is to cover enough population to draw comprehensive or global interpretations from the results, generalizing the outcomes requires careful consideration. Gathering data at large scales is also costly and time-consuming. For instance, researchers need to ensure that the respondents meet the diversity of the population, in terms of socio-economic status, culture, and history. Nonetheless, the findings are helpful for identifying

a trend or detect the change in the number of users of spaces under certain conditions (e.g., during the COVID-19 pandemic or wars).

Ugolini et al. (2020) studied 2,540 people across six countries (Croatia, Israel, Italy, Lithuania, Slovenia, and Spain) to examine the impacts of social isolation on the use and perception of urban green spaces during the pandemic (Ugolini, 2020). While snowball sampling has allowed them to collect data faster, easier and cheaper, the non-probability nature of such a strategy may compromise the odds that any particular participant could be selected. But, in general, they argue that their overwhelmingly urban samples with most respondents living in large cities, make the samples highly reflective of the entire European population. Nevertheless, they include Israel -not located in Europe- and each case consists of respondents who live in rural areas.

National-Level Studies and Sampling Challenges

Sampling public space users at the national level is also challenging, but studies at this scale can allow for a general understanding of the relationship between public spaces and public health. They can justify investments in public park/space improvement and provision. The nationwide studies in the U.S. and U.K. confirm the positive relationship between the quantity, quality, and accessibility of urban parks and their contribution to citizens' well-being at the city level (Larson, 2016). Such studies can highlight the importance of overlooked -hence undervalued- concepts in the policymaking process. They also reveal the data gap in this area and can lead to constructing a standardized data collection model. Even though using national datasets or secondary data at the national level facilitates research conduction, the findings are abstract and relatively lack details at the local level. There is no guarantee that the samples are representative of the whole

population. The heterogeneity of cities and urban neighborhoods requires context-oriented examinations of the population consuming the space, using the infrastructure, and contributing to urban life. In this regard, cluster sampling can be more beneficial for conducting national-level studies, but they are more expensive and take longer to collect data.

The nationwide studies -conducted during the COVID-19 pandemic still indicate the difficulties associated with sampling. In such urgent cases, researchers need to compromise between the comprehensiveness of the data and time limitations to produce effective frameworks. For instance, utilizing a convenient non-sampling method and recruiting individuals (16+) who spoke French and lived in France during the lockdown (March 25–30, 2020) eliminated certain groups of people. Larson et al. (2016) and Haesebaert (2020) weigh their data to compensate for disproportionalities in demographic attributes, selection probabilities, nonresponse rates, and selection bias. In general, their findings are beneficial for policymakers to direct their efforts toward improving existing policies (Haesebaert, 2020).

Urban-Level Studies and Sampling Challenges

Public space empirical studies at the urban level seem more manageable regarding getting more respondents involved in the sample. These studies can take one or a combination of the following formats. The first category includes comparative studies that assess two or more analogous cities to find similarities and differences between the public space users in different contexts and define a trend or behavioral patterns for further policy implications. For instance, Gashu et al. (2019) studied the perceptions and the use of green spaces in two cities in Ethiopia to indicate the importance of improving green

infrastructure. Their sampling strategy falls into quota sampling, where the sampling frame is unknown, and the researchers try to survey a certain number of people, sometimes provided by a formula. The authors use the Cochran formula to find the ideal sample size for their study (384 people). To avoid an unbiased estimate in survey distribution, the authors adopt a disproportionate sample and use a "proportion to size" method for the sub-cities they have chosen to study. But such samplings are non-probability sampling when every member does not have an equal chance of being selected for the research. Including more open space users requires more time and money and can be beyond the researchers' resources.

The second category consists of comparative studies at the urban level, where the researcher compares the open space users of purposefully selected public spaces. The comparison can take place between different size spaces (Ayala-Azcárraga, 2019; Sturm, 2014), the most popular and visited open spaces (Paul, 2022), or several main public spaces in a city (Sreetheran, 2017). The sampling strategies vary in these studies based on authors' preference and their available time and financial resources. The samples are usually randomly selected from the visitors or users of the spaces unless stated otherwise. Sampling public space users at this level still has challenges. For instance, the number of users from which samples are selected might be unknown due to the dynamic nature of the total users (Ayala-Azcárraga, 2019). The samples may not be demographically or socio-economically representative of the population (Francis J. W.-C., 2012). Adopting a stratified sampling strategy and using weighting factors to calculate an unbiased estimate (disproportionate sample) can alleviate the problem partially. For instance, in studying nine different-sized urban parks in Mexico City, Ayala-Azcárraga et al. (2019) chose the number of

respondents based on the park size (e.g., n= 61 for small, 120 for medium, and 157 for large parks).

Another constraint of sampling park users is the way that they are approached. Empirical studies on public space users recruit their subjects when they are resting or exercising. Doing so might decrease the response rate if the users are not willing to give up their leisure time participating in a survey. Consequently, it can prolong the study up to the point where the researchers collect the intended amount of data, making it exhausting and costly. But, some researchers avoid this limitation by asking about users' willingness to participate in the survey at a time that suits their schedules (Sreetheran, 2017).

The third category of empirical studies includes works that focus on specific characteristics of the users. For instance, they may target specific age groups (e.g., the elderly or children), gender (women, men, or the members of the LGBTQ), a particular socio-economic group (e.g., the low-income families, deprived neighborhoods, minorities, or the homeless population), or a population with illness or disability (e.g., people with Alzheimer, depression, anxiety, or physical disabilities). The research can be a combination of more than two of these populations or a comparison between two or more groups. These studies are usually objective-driven, and the characteristics of the samples seem to make them more manageable. However, there are still challenges and limitations in the sampling.

Enssle et al. (2020) explore the older people's visitation pattern of urban parks in Berlin and reduce the age base for the samples (50 years being the base age). They argue that their "preliminary qualitative research showed that older migrants are likely to feel they are part of the older generation in their 50s, which is earlier than people without a migrant background do" (Enssle, 2020, p. 37). They distributed surveys in social and

cultural places using the snowball strategy. Snowball sampling does not guarantee the likelihood of all intended populations being selected. It also fails to include frail people, the elderly at nursing homes, and minorities. Therefore, their sample does not represent all the older Berlin residents, except for the 506 participants (Ibid). Although the research reflects 506 people, it still provides insights into the older people's visitation pattern of urban parks and future studies regarding sampling strategies and subject recruitment.

In other instances, the characteristics of participants are chosen by the researcher(s) -purposive sampling strategy. For example, Berman et al. (2012) studied 19 adults diagnosed with MDD (major depressive disorder) to explore the relationship between nature interaction and cognition improvements in depressed individuals in Michigan. Although the small sample size of their study is one of their research limitations, four properties of their design decrease this drawback. First, they mention that their "effect sizes" were large. Second, the within-subjects nature of their study design reduces concerns about power. Third, other studies on this topic have a similar sample size. Finally, based on their large "effect size," their sample size could have consisted of only ten people in order to have "sufficient power to detect a significant interaction" (Berman M. G., 2012).

Another downside of sampling open space users in heterogeneous societies (sites) is the probability of excluding certain groups with no representatives in the sample. For instance, Abdul Malek and Mariapan (2009) explore the perception of urban park visitors about vandalism and safety issues in Shah Alam Lake Garden (Malaysia). Their sample tends to be comprehensive since it includes two types of park users (the daily users and the adjacent residents). First, they use a systematic random sampling based on every 5th person using the park on two weekdays and the 10th person seen at the park on two weekends.

Second, they survey residents within two blocks (1 km) from the park. These respondents could be either daily park users or not using it at all. But there still exist the limitations that the survey may not be reflective of the total park users and non-users, as the authors state, since a) it was administered during Ramadhan (Muslims' fasting month) when they may not use the park as they used to, and b) the surveys have not been translated into more languages other than Bahasa Malaysia and English. Assuming that Indians and Chinese would comprehend or know the two available languages holds the research back from being representative of the total population. These limitations, however, equip future studies to adopt more comprehensive samples for generalizing their findings.

Surveying Central Park Users: Sampling Strategy

Reviewing empirical studies -that explore the relationship between public spaces and public well-being- indicates that they cannot reflect the entire target population. But these studies provide more in-depth and specific results in their research fields. Accordingly, to conduct my empirical study on the contribution of Central Park to the community well-being of the residents of the Old Louisville neighborhood, I will conduct a 100%-household survey. There is no specific criterion for the participants. Even the household members who do not use the park can participate in the study and discuss the obstacles that bar them from using Central Park. Dropping off surveys at residences and giving the respondents enough time to participate in the study might facilitate participation for those with no or little spare time, the elderly and the indecisive residents. The close-ended questions in the questionnaire make it less time-consuming for those willing to participate. The ultimate goal of selecting a 100%-household survey and a questionnaire

with close-ended questions is to achieve a comprehensive and inclusive understanding of Central Park's functionality concerning the wellness of Old Louisville residents.

II Data Analysis

The responses to the first research question that depict how Old Louisville residents use Central Park will be presented in percentage form. The qualitative analysis of RQ1 is provided in Chapter Six. Then, the data is used to examine the association between park usage and well-being measures using multivariate and log-linear regression analyses.

Multivariate Regression Analysis

Different regression techniques are implemented to examine the associations between dependent and independent variables (e.g., logistic regression, ordinal regression, OLS regression, etc.). Since this research utilizes multiple independent variables with a small data set (n = 78), I have employed multivariate regression analysis to investigate the correlation between independent variables (the park usage frequency, accessibility, and reasons for the park visit) and four well-being measures (the perceived health index, health outcome index, mental well-being, and social well-being indices). The equations for the empirical models are presented below:

$$PHI = \alpha_0 + \alpha_1 * Frequency + \alpha_2 * PII + \alpha_3 * SI + \alpha_4 * AC + \alpha_5 * Age + \alpha_6 * Gender + \alpha_7 * Income,$$

$$HOI = \beta_0 + \beta_1 * Frequency + \beta_2 * PII + \beta_3 * SI + \beta_4 * AC + \beta_5 * Age + \beta_6 * Gender + \beta_7 * Income,$$

$$MWI = \mu_0 + \mu_1 * Frequency + \mu_2 * PII + \mu_3 * SI + \mu_4 * AC + \mu_5 * Age + \mu_6 * Gender + \beta_7 * Income,$$

$$SWI = \kappa_0 + \kappa_1 * Frequency + \kappa_2 * PII + \kappa_3 * SI + \kappa_4 * AC + \kappa_5 * Age + \kappa_6 * Gender + \kappa_7 * Income;$$

Where PHI stands for the perceived health index, HOI refers to the health outcome index, MWI represents the mental well-being index, SWI introduces the social well-being index,

and AC refers to the accessibility component. The indices are constructed using the PCA analysis, explained in Chapter Five. Additionally, I explored extant empirical studies and identified a set of control variables associated with an individual's well-being (e.g., age, gender, and income).

Log-Linear Regression Analysis

Since I am not certain if the relationships between dependent and independent variables are linear or non-linear, I have also used log-linear regression. The log-linear regression method is employed to predict the non-linear relationship between two or more variables (Raptor, 2022). The produced models in log-linear regression depict the association and interaction patterns between categorical variables (STAT, 2023). The log-linear equations for examining the relationship between seven independent variables and well-being measures are:

$$Ln(Y) = f\{Frequency, PII, SI, AC, Age, Gender, Income\}.$$

$$LNPHI = \alpha_0 + \alpha_1 * Frequency + \alpha_2 * PII + \alpha_3 * SI + \alpha_4 * AC + \alpha_5 * Age + \alpha_6 * Gender + \alpha_7 * Income$$

$$LNHOI = \beta_0 + \beta_1 * Frequency + \beta_2 * PII + \beta_3 * SI + \beta_4 * AC + \beta_5 * Age + \beta_6 * Gender + \beta_7 * Income$$

$$LNMWI = \mu_0 + \mu_1 * Frequency + \mu_2 * PII + \mu_3 * SI + \mu_4 * AC + \mu_5 * Age + \mu_6 * Gender + \beta_7 * Income$$

$$LNSWI = \kappa_0 + \kappa_1 * Frequency + \kappa_2 * PII + \kappa_3 * SI + \kappa_4 * AC + \kappa_5 * Age + \kappa_6 * Gender + \kappa_7 * Income$$

III Variable Selection: Dependent Variables

Assessing the associations between well-being aspects and green space exposure, usage, or proximity is a completed task, especially when the research focuses on perceived health, self-reported, or general health status. Researchers use different questions or tools across the literature depending on the research objectives. Most studies do not distinguish

between one's perceived health and health outcomes (e.g., blood pressure) to examine the association between park usage and physical well-being. Literature suggests the following measures to test the relationship between using green space and physical well-being, general, perceived, or self-reported health status: (1) having good health and enough energy to conduct daily activities (Larson, 2016; Holt, 2019; Ayala-Azcárraga, 2019; Enssle, 2020), (2) BMI, cholesterol level, blood pressure, blood sugar (Paul, 2022; Epstein, 2012; Piferi, 2006), and (3) respiratory and cardiovascular disease (Yeager R. R., 2018; Su, 2016). In some cases, the researchers focus on one question about general health with a 5 or 7-point Likert scale response (Ayala-Azcárraga, 2019; Paul, 2022). Other general health questionnaires are the General Health Questionnaire (GHQ-12, 28), 36-Item Short Form Survey Instrument (SF-36), WHO-5, or a combination of these tools. After conducting Spearman's Correlation and PCA analyses, the BMI and respiratory illnesses were excluded from final regression models for assessing physical well-being.

Multiple measures can be utilized to determine the relationship between mental well-being and green space usage, exposure, accessibility, or proximity. Stress, anxiety, depression, affect, mood, cognition, rumination, loneliness, calmness, and tiredness are the most used mental well-being measures. The usual assessment tools include Short Form Survey Instrument (SF-36) (Sturm, 2014), World Health Organization-5 (White, 2021), Mood Profile of Mood States Questionnaire (Li, 2018), Perceived Stress Scale (Cohen-Cline, 2015; Beil, 2013; Pun, 2018), State-Trait Anxiety Inventory (Bratman G. N., 2015 b), Depression Anxiety and Stress Instrument (Beyer, 2014), The Mental Health Inventory - 5 (MHI-5), and Center for Epidemiologic Studies Depression Scale (CES-D) (Pun, 2018). Depression and anxiety medication intake did not have a statistically significant

relationship with independent variables, therefore not used for further statistical analysis.

The main measures for social well-being include (1) having social support, the existence of connections and relationships among neighbors, (2) taking care of each other, (3) Social Connectedness Scale (Hadavi, 2017), and (4) Social Support Questionnaire (SSQ). This research included three well-being measures that were reduced to two components after conducting the PCA to construct social well-being index (Please see the following section).

Dependent Variables

This research studies three domains of well-being: physical, mental, and social well-being. The well-being measures are developed based on a set of survey questions. These measures will serve as dependent variables in regression analyses. According to the literature (Chapter II), various factors contribute to an individual's well-being. The genetic factors, lifestyle (e.g., having an active or sedentary lifestyle, drinking/smoking/eating habits), demographic characteristics (e.g., age, gender, race, and ethnicity), and education and economic status affect will-being (CDC., 2018; Kobau, 2010; Richardson E. a., 2010). Moreover, the physical and environmental attributes of one's surroundings influence their well-being. For instance, proximity to landfills (e.g., waste facilities) has negative impacts on residents' health, while exposure and access to green public spaces improve well-being in various aspects (e.g., physical, mental, and social) (Becchetti, 2009; Ayala-Azcárraga, 2019; Baur, 2013).

The physical well-being variable includes ten measures, BMI, disability, perceived health (four measures), hypertension, high cholesterol, diabetes, and respiratory illness. The mental well-being variable consists of six measures that assess tiredness, nervousness,

sadness, calmness, being energetic, and taking depression or anxiety medicine. The social well-being variable comprises three measures: the ability to conduct social activities, having social support, and using the park for socializing.

IV Variable Selection: Independent and Control Variables

The literature suggests that following independent variables contribute to park users' well-being: (1) frequent park visits (Francis J. W.-C., 2012; Schnell, 2019; Romagosa, 2018), (2) park usage regularity (Shanahan, 2016), (3) the duration of park visits (Hazer, 2018; Yuen, 2020), (4) park accessibility (Epstein, 2012; Villanueva, 2015), (5) park quality (Hadavi, 2017; Francis J. W.-C., 2012; Ayala-Azcárraga, 2019), (6) park proximity (Baur, 2013; Hadavi, 2017; Sturm, 2014), and park-based activities (Almanza, 2012; Baur, 2013; Burgess, 2021). Other measures -utilized to construct the independent variables- are the park's safety, maintenance, and satisfaction. For instance, Hadavi (2017) used park satisfaction as a mediating variable. The survey for the current research inquired about frequent park visits, usage duration, and regularity, park-based activities (e.g., exercising, meditating, walking one's dog, mood improvement, and socializing), park proximity, and park quality (e.g., accessibility, inclusiveness, satisfaction, and safety). After conducting Spearman's Correlation method to examine the statistically significant association between these measures and dependent variables, the insignificant association between them resulted in reducing the number of components. For instance, park visit duration, regular park visits, proximity, safety, and satisfaction were excluded from further analysis. The number of park-based activities was reduced after conducting the PCA (Principal Component Analysis). For instance, walking one's dog was excluded from the final regression models, and other activities were consolidated into two categories:

personal interest and socializing activities (detailed information is provided in Chapter Five).

As for the control variables, age, gender, income, race, ethnicity, education attainment, household size (Piferi, 2006), housing type (Beyer, 2014), marital status (Hadavi, 2017; Beyer, 2014), smoking habit (Yeager R. R., 2018), and occupational status are the most utilized variables in this field. This study asked for the following: household size, gender, age, marital status, education, ethnicity, race, income, employment status, housing type, and presence of any common/private outdoor spaces in respondents' residences. The final regression models did not include ethnicity since the surveys returned by Hispanic respondents missed some data, hence, excluded from regression analysis. Spearman's Correlation method was utilized to determine which control/mediating variables have statistically significant relationships with the well-being measures. Ultimately, gender, age, and income were implemented in regression analysis.

Independent Variables: Park Usage Pattern (X)

The park usage frequency is the first independent variable, which will be used to test my hypothesis. I hypothesized that park usage contributes to the community's physical, mental, and social well-being. Respondents can use the park daily (highest frequency) or less than/once a month (lowest frequency). I am expecting the coefficient of frequency to be positive on three well-being variables, indicating that more park usage contributes to physical (e.g., better perceived health, lower blood pressure, cholesterol, and diabetes), mental wellness (e.g., less depression, anxiety, and tiredness, and more calmness conditions), and social well-being (e.g., having social support, attending the park for social interactions).

Two activity patterns comprise other independent variables: first, the park-based physical activities conducted for personal interests (e.g., exercising), and second, activities that meet an individual's social needs (e.g., socializing or attending social events) that are suggested to contribute to physical and social well-being (Almanza, 2012; Burgess, 2021). Accordingly, I hypothesize that people who use the park for park-based physical activities will perform better-perceived health. For instance, they will state having excellent health status, getting sick less than others, and not being forced to cut down on activities due to poor physical health. In addition, more park-related physical activity will translate into better health outcomes, such as lower blood pressure, cholesterol, and diabetes. Hence, the expected coefficient of park-based physical activities should be positive, validating my hypothesis that using Central Park to conduct physical activities is associated with better physical well-being. The second set of park-related behaviors pertains to my third research question and will test if using the park for socializing or attending social events promote the user's social wellness. Hence, I expect the park-based social activities to have a positive coefficient in regression models, providing evidence to support my hypothesis.

The only feature of the built environment that is the independent variable in this study is the level of accessibility to the park. Respondents describe the level of accessibility by providing information about the subjective distance between their residences and Central Park (very poor - excellent). Moreover, the presence of physical barriers defines if people can easily access the park. The accessibility component (AC) -constructed in the PCA analysis- is supposed to facilitate frequent park usage, thus, contributing to the users' better physical, mental, and social well-being. Therefore, the expected accessibility component coefficient should be positive, suggesting that better park access is associated

with better-perceived health, health outcomes, and more desirable mental and social well-being.

Socio-Economic Characteristics (Control Variables)

Socioeconomic characteristics affect people's well-being. Even though the findings regarding the contribution of these features to one's well-being status are inconclusive, age, gender, and income are not insignificant in most studies. Moreover, green space usage does not have uniform health benefits for all populations (Richardson E. a., 2010; Larson, 2016). Accordingly, I have selected gender, age, and income as the control variables. The gender variable in the regression analysis will depict different ways men and women use Central Park, therefore, benefiting from it. The age variable is implemented in models to examine how respondents' age difference affects park usage and well-being. Finally, the income variable in the regression analysis depicts how respondents' economic condition accounts for physical, mental, and social well-being among people with different incomes.

CHAPTER IV DATA COLLECTION

This research uses Central Park in Louisville, KY, as a case study and aims to explore whether and how the park contributes to the physical, mental, and social well-being of Old Louisville residents.

I Survey Design

The survey is designed to collect information about (1) the ways residents use the park, (2) park attributes, (3) residents' socio-economic status, and (4) well-being attributes. Please see Appendix I for the survey. The measures for the physical, mental, and social well-being indicators, park usage and quality, socio-demographic status, and housing type are created based on reviewing the existing literature.

The survey consists of four sections. The first section is about park usage patterns including a) frequency of use, b) duration of use, c) usage regularity, d) transportation modes to get to the park, e) user's preferred visit time, f) the distance from one's residence to the park, and g) reasons for visiting Central Park. The frequency of use question (how frequently do you use the park?) has four answer options: daily (the highest frequency) to less than/once a month (the lowest frequency). The average time spent in the park (duration) has four options: less than 15 minutes, 15-30 minutes, up to one hour, and more than one hour. Regular visits to the park can happen on weekdays, weekends, holidays, special occasions, during spare time, or all the choices. The transportation modes to get to

the park from one's home can be selected from one of the following a) using a personal vehicle, b) riding a bike, scooter, or wheelchair, c) walking, or d) taking the bus. Participants indicate their preferred time to go to the park on one or more occasions during the day or night. The responses to this question include morning, noon, afternoon, evening, and night. The participants are asked to determine how far they live from Central Park. The response varies from less than 5 minutes to more than 30 minutes. The first section concludes by inquiring about people's main reasons for visiting and using the park, such as exercising, walking their dogs, meditating, socializing, enjoying the natural environment, improving one's mood, and attending social events. Respondents could answer yes, somewhat, or no.

The second section is about the park's quality. It includes accessibility, inclusiveness, satisfaction with the park's management, amenities, recreation facilities, safety, and comfortable areas. There are two accessibility questions to assess: a) the accessibility to the park from one's residence and b) the presence of physical barriers that limit access to the park. The first question refers to subjective access to the park, and responses were based on a 5-point Likert scale (Very poor = 1, Poor = 2, Fair = 3, Good = 4, and Excellent = 5). The second question has a yes-no option. Questions that address inclusiveness ask if all genders, age groups, and disabled people can use the park. The answer options include Yes = 3, Somewhat = 2, and No = 1.

People's satisfaction with the park's management and facilities are addressed in two questions where: Yes = 3, Somewhat = 2, or No = 1. Respondents are asked to rate how they perceived the park's safety during the daytime and after dark in the past year compared to the pre-COVID-19 era. The answers are based on a 7-point Likert scale

(Decreased a lot = 1, Decreased moderately = 2, Decreased a little = 3, No change = 4, Increased a little = 5, Increased somewhat = 6, Increased a lot = 7). Respondents are also asked to specify amenities that make the park a comfortable place for them (e.g., seats, amphitheater, playground, and so on).

The third section of the questionnaire asks about respondents' socioeconomic characteristics. Questions regarding the number of people in the household, gender, age, marital status, education, ethnicity, race, education, income level, and employment status collect information about the background of park users. Asking about housing type and whether the residential units have third spaces (e.g., backyards or balconies) helps find the relationship between building types, park usage, and community well-being.

Section four consists of three subsections that inquire about respondents' physical, mental, and social well-being. The physical well-being section includes questions about respondents' height and weight to calculate their BMI using an online BMI calculator. Other questions were about having physical disabilities (Yes = 0, No = 1), and perceived health questions. For instance, the PW2 question (My health is excellent.) has the following response choices: Definitely true = 5; Mostly true = 4; Don't know = 3; Mostly false = 2, and Definitely false = 1. PW3 asks if people felt to get sick easier than others. The responses to this question include a 5-point Likert Scale (Definitely true = 1; Mostly true = 2; Don't know = 3; Mostly false = 4, and Definitely false = 5). This section inquiries about the respondent's lack of ability to conduct physical activities in the past two weeks,

the diagnoses of hypertension[1], hypercholesterolemia[2], diabetes, and respiratory diseases[3]. These questions had dichotomous yes-no answers (Yes = 0, No = 1).

The mental well-being section investigates respondents' mental health in the last two weeks. Questions include tiredness (MW1), nervousness (MW2), depression (MW3), calmness (MW4), and being energetic (MW5). The responses are based on a 6-point Likert scale. The values for MW1 to MW3 are defined as follows; All of the time = 1; Most of the time = 2; A good bit of the time = 3; Some of the time = 4; A little bit of the time = 5; and None of the time = 6. The MW4 and MW5 responses are scored in the following terms: All of the time = 6; Most of the time = 5; A good bit of the time = 4; Some of the time = 3; A little bit of the time = 2; and None of the time = 1. Participants also answer a yes-no question about taking depression or anxiety medicine (MW6).

Lastly, respondents' social well-being is assessed by three questions two of which have identical 5-point Likert scale answers. Questions are a) how much of the time their physical health or emotional problems interfered with their social activities (like visiting with friends, relatives, etc.), b) if they had a companion if they wanted to go on a day trip, and c) if they enjoy attending parks and other public spaces to be around people. The answers to the first question include All of the time = 1; Most of the time = 2; Some of the time = 3; A little bit of the time = 4, and None of the time = 5. The remaining questions have the following response choices: Strongly agree = 5; Agree = 4; No opinion = 3; Disagree = 2, and Strongly disagree = 1.

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[1] - High blood pressure

[2] - High cholesterol

[3] - Asthma, chronic bronchitis, lung cancer, pneumonia, etc.

II Study Area

Central Park is the largest and most significant green public space within the dense urban fabric of the Old Louisville neighborhood. Olmsted brothers designed the park in 1904. It provides 16.67 acres of green space and key amenities for Louisville residents (Conservancy, Central Park). Central Park in Louisville has provided a pleasant environment for Old Louisville residents to escape the stresses of modern life in a dense neighborhood (Conservatory, 2022).

The park is accessible from four adjacent streets, and the most frequent bus route and stations on the S 4th St. make it more convenient for its users (Figure 4.1). Besides the amenities (e.g., amphitheater, playground, restrooms, tennis, and volleyball courts), Central Park hosts events such as the Shakespeare Festival, which is the "longest-running free, non-ticketed Shakespeare festival in the United States" (Shakespeare, 2021). The survey allowed me to collect information about residents' physical, mental, and social well-being and assess the relationship between park usage and their overall well-being. Since the Old Louisville neighborhood is dense and populated, the results of this research will provide insights into the importance of green public spaces, especially in dense urban areas, as well as implications for existing and future urban developments (e.g., design guidelines and policies).

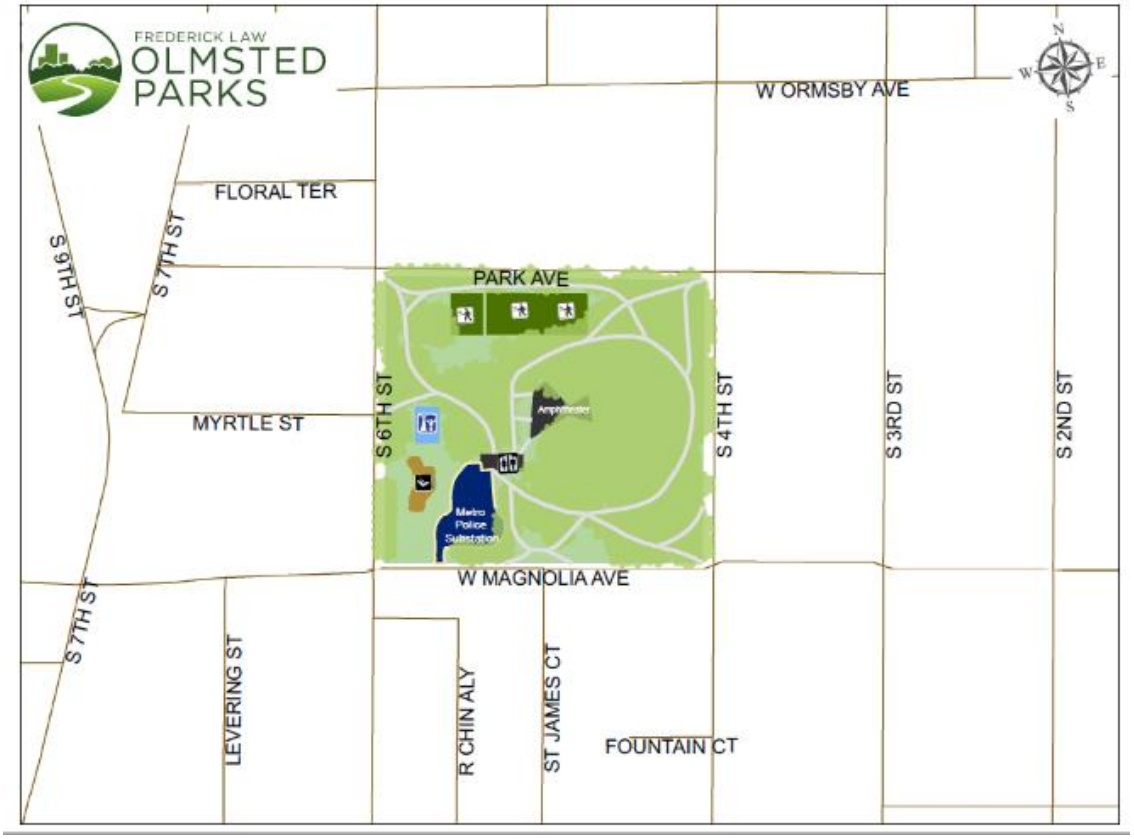


Figure 4.1 The Central Park

Source: (Conservancy, n.d.)

Figure 4.2 illustrates the study area, which includes Central Park and its surrounding areas. The industrial land use on the west and Highway I-65 on the east set the boundaries for the study area on these sides. The boundaries on the north and south of the study area are defined based on the most effective distance to public parks. The literature suggests a range of Euclidean distance from the residential units to the edges of a park being between 0.25 to 0.5 miles. Park users can walk or bike to the park for between 5 to 15 minutes (Fermino, 2012; Koohsari, 2013). For instance, Sturm, 2014 found that mental health is significantly related to residential-park distance. The highest Mental Health Index-5 (MHI-5) belonged to the residents whose walking distance from the park was 0.25 miles. The score decreased significantly as the distance increased to 0.5 and 1 mile. The

average Euclidean distance to Central Park is 0.37 miles in this study.

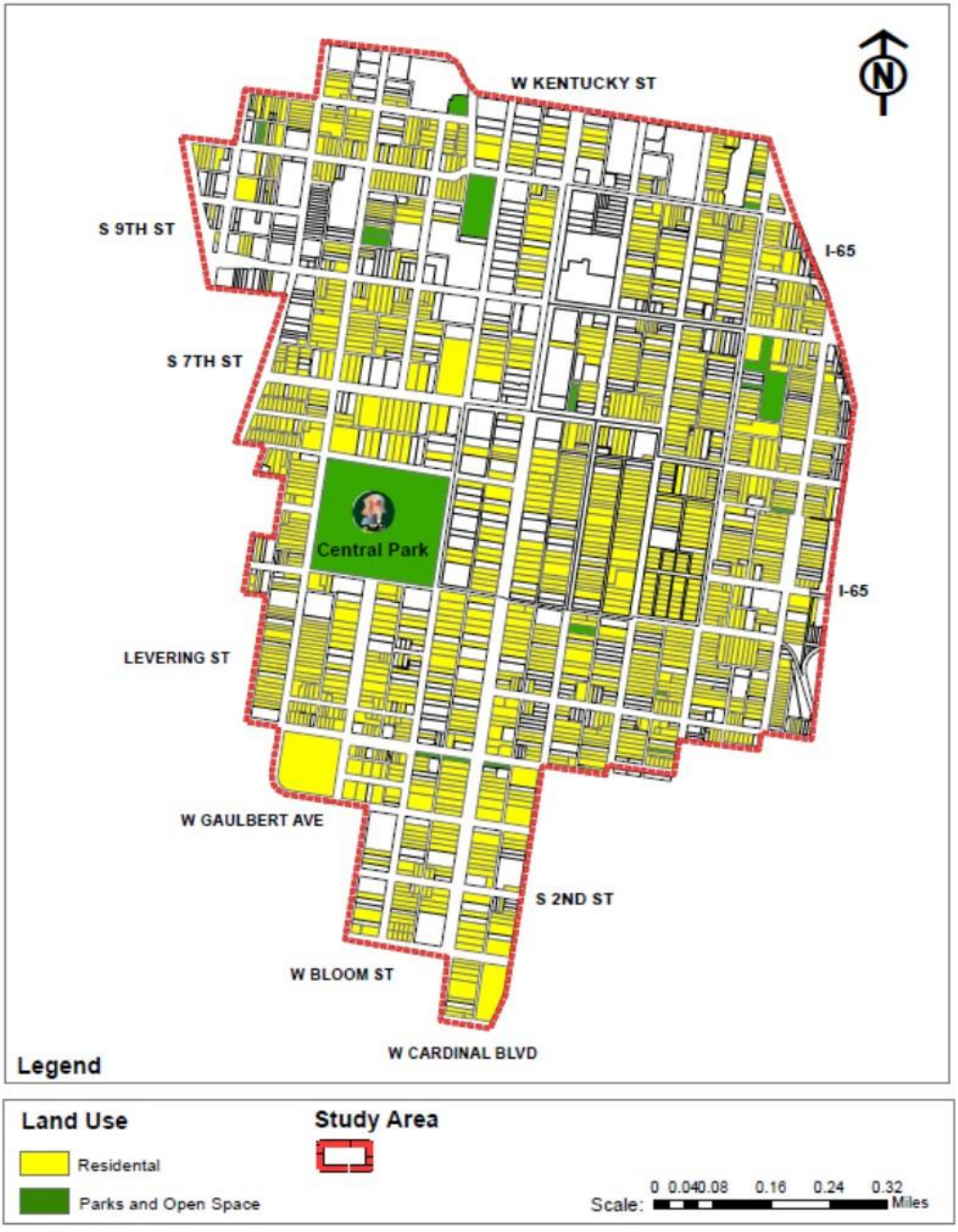


Figure 4.2: Area of Study

III Data Collection

There is no standardized and perfect prescription for sampling strategy. Chapter III

provided a more detailed description of sampling strategies in studies concerning green space and well-being. The scale, objective, population, time of the study (e.g., seasons), and urgency are some factors that affect the sampling strategy. Empirical studies that explore the relationship between public spaces and well-being, often collect data through one or more of the following resources: 1) secondary data (Larson, 2016), 2) on-site survey/interviews (Grima, 2020; Hadavi, 2017), 3) online survey/interview (Lopez, 2021), or 4) recruiting participants with specific criteria such as age (Almanza, 2012), gender (Yin, 2022), ethnicity (Kim J. L., 2014), or specific illnesses (Berman M. G., 2012). While such data is informative and provides insights into the association between public green space and well-being, a whole-household survey of the study area is more likely to address more citizens than other data collection methods. Accordingly, to conduct my empirical study on the contribution of Central Park to the community well-being of the residents of the Old Louisville neighborhood, I conducted a 100%-household survey of the single and multi-family housing and apartments in the study area.

I obtained the mailing address of all residential units in the study area from the Jefferson County Parcel Valuation Administration (PVA) records (County, 2021) to conduct a whole-population mail-in survey of the single/multi-family housing and apartments in the study area. After determining the area of study, I used each address's Parcel ID (obtained from the attribute table of the selected properties in ArcGIS) and looked for the number of units in every property on the LOJIC website. Doing so allowed me to discover the number of units in the study area for preparing hard copies of the survey questions, unsigned consent forms, and stamped return envelopes. The "unsigned informed consent" form provided information about the research background and purpose, as well

as the principal investigator's and the co-investigator's names, affiliations, and contact information. There are 836 single-family housing, 356 multi-family or duplex units, and 2,619 apartment units. The total number of units in the area is 3,811. But after subtracting the vacant units (to which I did not deliver the survey to them), I distributed 2,945 surveys. This survey does not recruit specific participants. One member of each household was invited to complete the survey.

A traditional pilot survey was first conducted. Each household received an envelope containing the questionnaire, the "unsigned informed consent" form, and a stamped return envelope. Two-hundred households received the survey package. Thirty-three households mailed back the survey, with a response rate of 16.5%. A second pilot survey sent survey packages to 200 households, which included an introduction of the research with a QR code and the consent form. The QR code directed participants to a Google form, where they could complete the survey online. Fifty-eight households responded, with a response rate of 29%.

The use of QR codes for online surveys yields a higher response rate. I decided to use the online option to return surveys for the rest of the households in the study area. The survey distribution started on October 6th, 2022, and ended on November 22nd, 2022. I entered the returned responses into the Google form platform to consolidate data from both data-collection modes. By December 13th, 2022 (fourteen business days after the last day of survey distribution), a total of 119 responses were received in the mail or online from both pilot studies. Then, I downloaded the data as an Excel file for cleaning and further analysis. Routine data cleaning was performed, which included reviewing responses for possible errors and detecting incomplete or non-responses. After cleaning the data and

discarding the surveys with missing data, 78 surveys remained for analysis. These observations have no missing data, and respondents had answered all the questions. Nonetheless, I have provided the descriptive analysis for both data sets. The following chapters (V and VI) provide the descriptive statistics for two sets of observations: the full and the partial data sets (n = 78). I have compared the data sets with their corresponding features at the census tract and county levels. The full data set observations' count vary based on the number of questions that have been answered.

CHAPTER V ANALYSES OF WELL-BEING

As mentioned in Chapter IV, 119 surveys were returned, 78 of which had the answer to all survey questions. The remaining 41 returned surveys have missing data. This chapter and chapter Six will provide descriptive analyses for both datasets. The partial data set includes the surveys with no missing data (n = 78), and the full data set has a different number of observations. However, the full data set comprises partial data and incomplete surveys.

I Physical Well-being

Ten variables focus on physical well-being. Body Mass Index (BMI) measures a person's weight in relation to height. It is commonly used to screen for health problems related to weight. As shown in Figure 5.1, the average BMI is 27.24 (n = 78) and 26.31 (n = 110). Both graphs have a skewed distribution to the right, which is slightly lower than the 2017-18 national figures of 29.8 (Liu, 2021).

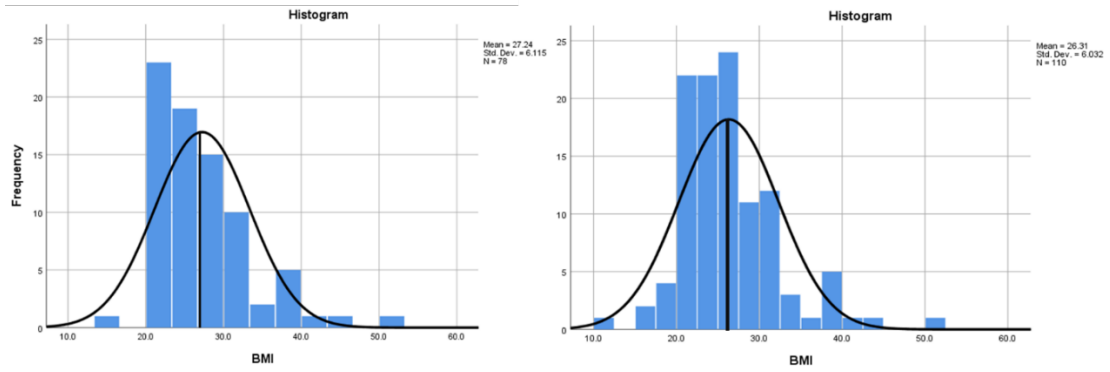


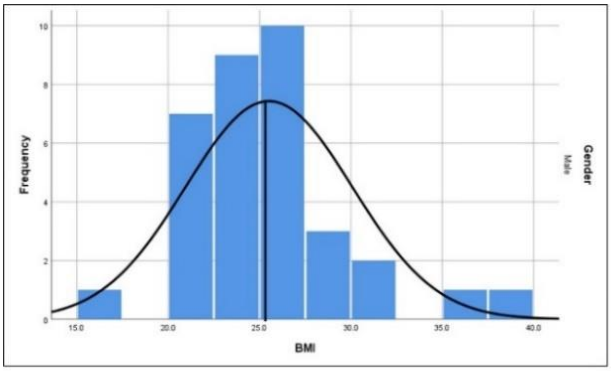
Figure 5.1: BMI Distribution in two Data Sets

Table 5.1 further presents the frequency distribution of two sets of observations (n = 78 and n = 110) by BMI categories. In both sets of data, more than 40% of the respondents had normal weight, followed by 32% overweight, and 26% and 22% obese in partial and full data sets, respectively. The obesity rate is much lower than the Kentucky average, which is greater than 40% in 2021 (CDC., 2022).

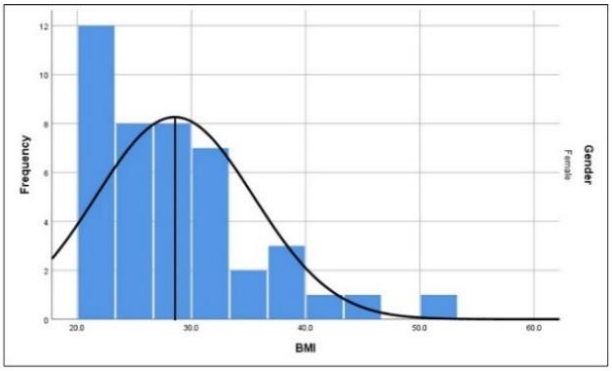
Table 5.1: Number of People by BMI Categories in Partial and Full Datasets

BMI Categories	**BMI**	**N = 78**		**N=110**	
		Frequency	**Percent**	**Frequency**	**Percent**
Underweight	<18.5	1	1.0	3	1.0
Normal Weight	18.5-24.9	32	41.0	48	43.0
Overweight	25-29.9	25	32.0	35	32.0
Obesity	>30	20	26.0	24	22.0
Total		78	100	110	100

The mean BMI for the male and female participants (n = 78) is 25.5 and 28.5, respectively (Figure 5.2). These figures are much lower than the 2021 Kentucky figures of 39.8% for males and 40.9% for females (CDC., 2023).



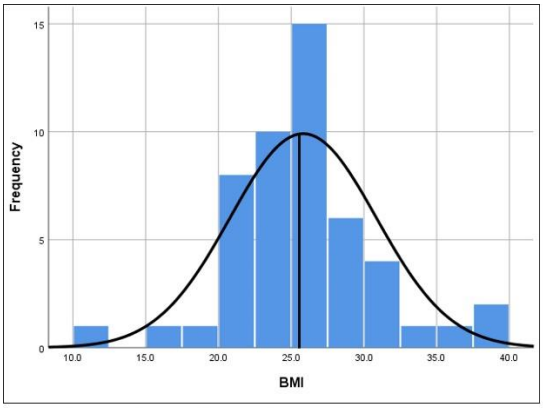
Male	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
BMI	34	23.9	15.1	39	25.512	4.5634	20.825



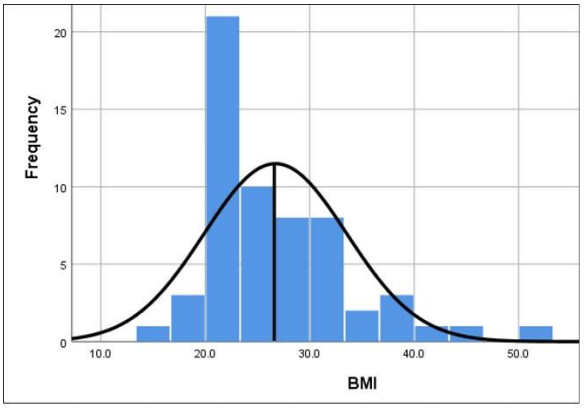
Female	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
BMI	43	31.3	20.4	51.7	28.53	6.918	47.858

Figure 5.2: BMI Distribution in the study area by gender (n = 78)

Figure 5.3 presents the mean BMI for the male and female participants in 109 observations in the study area. The mean BMI for the male respondents is 25.83 and 26.71 for the female participants. The results are consistent with the partial data set (n = 78). The male-female difference among the respondents is in line with the higher obesity prevalence among Kentuckian women than men.



Male	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
BMI	50	27.9	11.1	39	25.83	5.03	25.32



Female	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
BMI	59	36.6	15.1	51.7	26.71	6.82	26.71

Figure 5.3: BMI Distribution in the study area by gender (n = 109)

PW2 (My health is excellent) and PW3 (I seem to get sick a little easier than others) rate people's perceived health status based on a 5-point Likert Scale. According to Table 5.2, most people noted that they had excellent health (85.9%), and 67.9% of respondents stated that they did not get sick easier than others.

Table 5.2: Self-reported Perceived Health Status (n = 78)

Responses	**PW2** (My health is excellent.)		**PW3** (I seem to get sick a little easier than others.)	
	Frequency	**Percent**	**Frequency**	**Percent**
Definitely true	21	26.9	3	3.8
Mostly true	46	59.0	10	12.8
Don't know	5	6.4	12	15.4
Mostly false	6	7.2	21	26.9
Definitely false	0	0	32	41.0

According to Table 5.3, 89% of participants stated having excellent health. Only 13% of respondents thought that they got sick easier than others. The results for both data sets are consistent and indicate the majority of respondents have good perceived health.

Table 5.3: Self-reported Perceived Health Status (n = 117)

Responses	**PW2** (My health is excellent.)		**PW3** (I seem to get sick a little easier than others.)	
	Frequency	**Percent**	**Frequency**	**Percent**
Definitely true	33	28.0	5	4.0
Mostly true	71	61.0	11	9.0
Don't know	5	4.0	17	15.0
Mostly false	7	6.0	35	30.0
Definitely false	1	1.0	49	42.0

In the partial data set (n = 78), ten respondents (13%) have disabilities. The number of participants with disabilities is 14 (12.4%) in the full data set (n = 113). Figure 5.4 presents the results for six physical well-being measures with yes-no responses. The majority of the respondents did not have difficulty performing their work as a result of physical health (PW4) (89.7%), and 85.9% were able to function properly without being forced to cut down on the amount of time they spent on work/activities as a result of their physical health (PW5). The majority of the sample population is healthy in terms of having

normal blood pressure (74.4%), not having high cholesterol (69.2%), not being diabetic (85.9%), and not having any respiratory illnesses (69.2%). The statistical analysis of the full data set indicates consistent results with the partial data set (n = 78). They both refer to the overall good physical well-being status of the respondents (Figure 5.5).

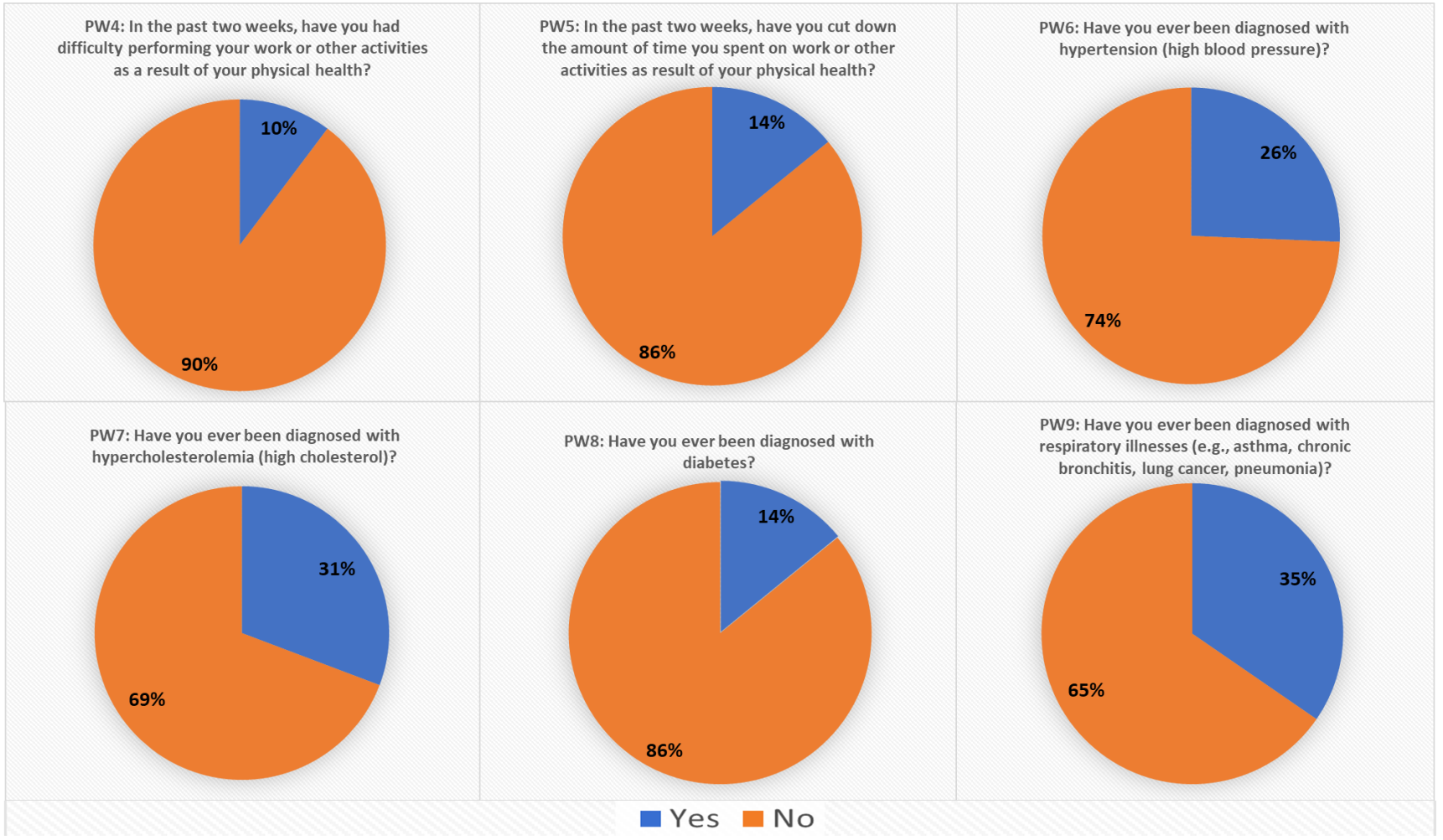


Figure 5.4: Physical Well-being Measures (n = 78)

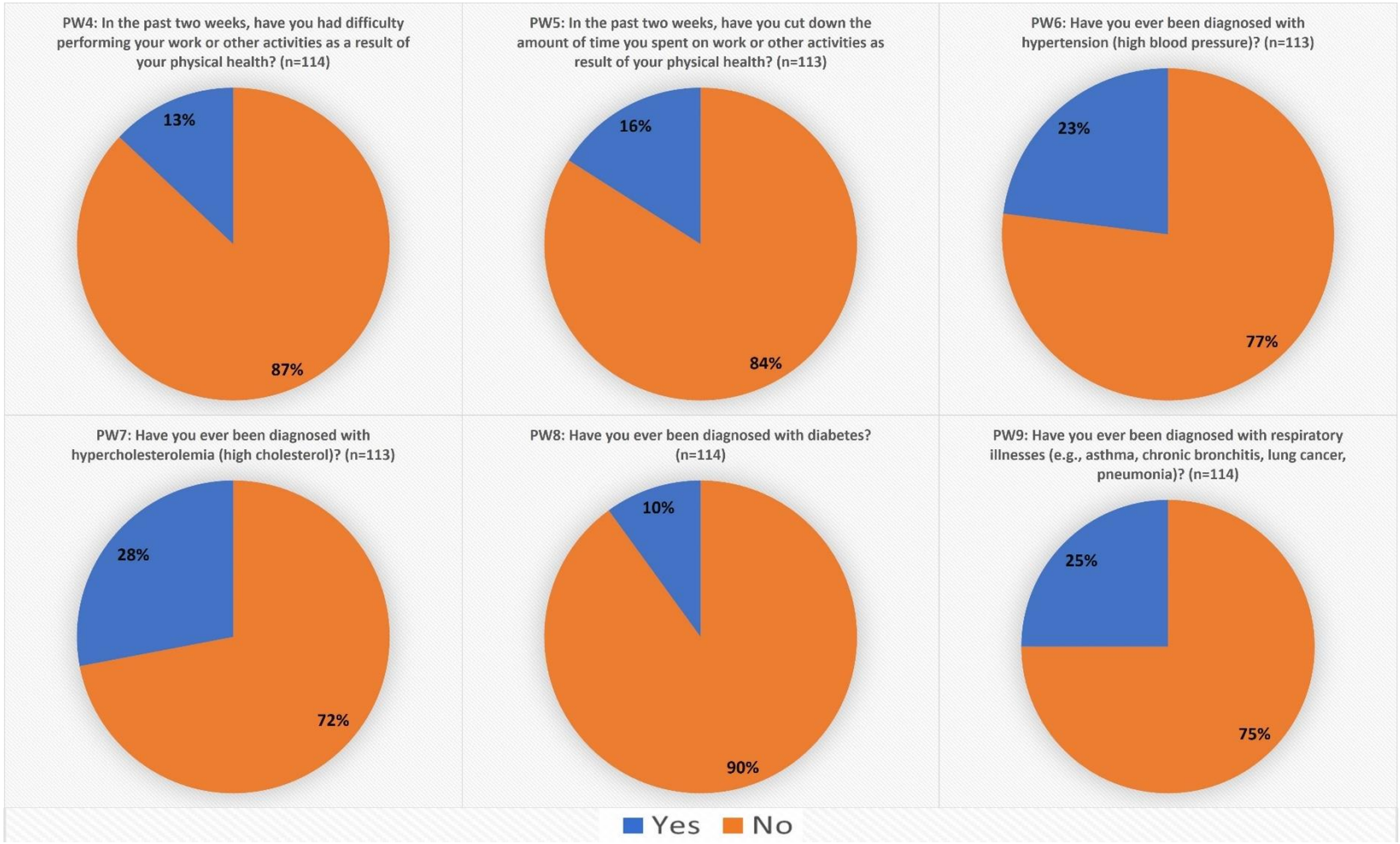


Figure 5.5: Physical Well-being Measures (Full Data Set)

Spearman's Correlation Analysis of Physical Well-being Measures (n = 78)

Table 5.4 presents Spearman's Correlation coefficients. The results indicate that there is a weak negative correlation between BMI and PW2 -respondents' self-assessed health measure [r = -.215, $p < 0.05$]. Moreover, there is a moderate negative correlation between BMI and participants' diagnoses of blood pressure- PW6 [r = -0.316, $p < 0.001$]. Both correlations are statistically significant. Other negative correlations between BMI and physical well-being indicators showed to be negligible in this study.

Table 5.4: Spearman's Correlation Analysis of Physical Well-being Variables (n = 78)

	BMI	**PW1**	**PW2**	**PW3**	**PW4**	**PW5**	**PW6**	**PW7**	**PW8**
PW1	0.215								
PW2	-.231*	.425**							
PW3	-0.120	.301**	.491**						
PW4	0.038	.250*	0.177	.319**					
PW5	0.067	.396**	.283*	.448**	.592**				
PW6	-.316**	0.038	0.175	0.086	-0.005	0.015			
PW7	-0.086	0.160	0.193	0.212	-0.042	0.209	0.181		
PW8	-0.126	0.065	0.160	.279*	0.106	0.047	.268*	.368**	
PW9	-0.180	0.043	0.167	.262*	-0.068	0.170	0.190	.274*	0.170

**. Significant at the 1% level.
*. Significant at the 5% level.

PW1: Do you have any physical disabilities? Yes = 0, No = 1.
PW2: My health is excellent. Definitely true = 5, Mostly true = 4, Don't know = 3, Mostly false = 2, Definitely false = 1.
PW3: I seem to get sick a little easier than other people. Definitely true = 1, Mostly true = 2, Don't know = 3, Mostly false = 4, Definitely false = 5.
PW4: In the past two weeks, have you had difficulty performing your work or other activities as a result of your physical health? Yes = 0, No = 1.
PW5: In the past two weeks, have you cut down the amount of time you spent on work or other activities as result of your physical health? Yes = 0, No = 1.
PW6: Have you ever been diagnosed with hypertension (high blood pressure)? Yes = 0, No = 1.
PW7: Have you ever been diagnosed with hypercholesterolemia (high cholesterol)? Yes = 0, No = 1.
PW8: Have you ever been diagnosed with diabetes? Yes = 0, No = 1.
PW9: Have you ever been diagnosed with respiratory illnesses and diseases (e.g., asthma, chronic bronchitis, lung cancer, pneumonia, etc.)? Yes = 0, No = 1.

The results indicate a strong positive relationship between those claiming not to be disabled (PW1) and respondents' self-reported general health (PW2) [r = 0.425, $p < 0.001$]. There is a moderate positive association and a statistically significant correlation between respondents' disability (PW1) and PW5 -the amount of time they had to cut down on work/activities due to their physical health [r = 0.396, $p < 0.001$].

There is a strong positive relationship between people's self-reported health condition (My health is excellent: PW2) and (PW3) feeling to get sick less than others [r = 0.491, $p < 0.001$]. There is also a weak positive and statistically significant relationship between an individual's general health (PW2) and the amount of time they did not operate their work or other activities as a result of their physical health issues- PW5 [r = 0.283, $p < 0.05$].

The results show a moderate positive relationship and a statistically significant correlation between how individuals perceived their health (e.g., getting sick easier than others: PW3) and (PW4: having difficulty performing their work/activities as a result of their physical health [r = 0.319, $p < 0.001$]. There is a strong positive relationship and a statistically significant correlation between the number of people who think they get sick easier than others (PW3) and (PW5) having to cut down the amount of time they spend on work/activities as a result of their physical health [r = 0.448, $p < 0.001$]. There is also a weak positive relationship between feeling sick more than other people (PW3) and (PW8) being diabetic [r = 0.279, $p < 0.05$].

There is a strong positive relationship between respondents having difficulty performing their work due to physical health (PW4) and (PW5) the amount of time they had to cut down on their work/activities because of their physical health [r = 0.592, $p <$

0.001]. There is a moderate positive relationship between having high cholesterol (PW7) and (PW8) being diabetic [r = 0.368, $p < 0.001$].

There is a moderate positive relationship between being disabled (PW1) and PW3- feeling sick more than others [r = 0.301, $p < 0.001$]. Moreover, the relationship between having difficulty performing work due to physical health (PW4) and (PW1) having disabilities is a weak positive relationship [r = 0.250, $p < 0.05$]. The results indicate a weak positive relationship between getting sick easier than others (PW3) and having respiratory illnesses (PW9) [r = 0.262, $p < 0.05$]. There is a weak positive relationship between having high blood pressure (PW6) and (PW8) being diabetic [r = 0.268, $p < 0.05$]. Finally, the results show a weak positive relationship between having high cholesterol (PW7) and being diagnosed with respiratory illnesses (PW9) [r = 0.274, $p < 0.05$].

Spearman's Correlation Analysis of Physical Well-being Measures (Full Data Set)

The results of Spearman's Correlation coefficients for the full-data set are presented in Table 5.5. The results indicate that there is a weak negative correlation between BMI and participants' diagnoses of blood pressure- PW6 [r = -0.244, $p < 0.05$]. Other negative correlations between BMI and physical well-being indicators showed to be negligible in this study.

The results indicate a moderate positive relationship between those claiming to not have a disability (PW1) and respondents' self-reported general health (PW2) [r = 0.384, $p < 0.001$]. There is a moderate positive relationship between being disabled (PW1) and PW3- feeling sick more than others [r = 0.300, $p < 0.001$]. There is a moderate positive association and a statistically significant correlation between respondents' disability (PW1) and PW5: the amount of time they had to cut down on work/activities due to their physical

health [r = 0.333, $p < 0.001$].

There is a strong positive relationship between people's self-reported health condition (My health is excellent: PW2) and (PW3) feeling to get sick less than others [r = 0.534, $p < 0.001$]. The results show a weak positive relationship between participants' self-reported health status (PW2) and PW4 -having difficulty performing activities as a result of one's physical health [r = 0.266, $p < 0.001$]. There is also a moderate positive and statistically significant relationship between an individual's general health (PW2) and the amount of time they did not operate their work or other activities as a result of their physical health issues- PW5 [r = 0.336, $p < 0.001$].

The results show a moderate positive relationship and a statistically significant correlation between how individuals perceived their health (e.g., getting sick easier than others: PW3) and (PW4) having difficulty performing their work/activities as a result of their physical health [r = 0.331, $p < 0.001$]. There is a strong positive relationship and a statistically significant correlation between the number of people who think they get sick easier than others (PW3) and (PW5) having to cut down the amount of time they spend on work/activities as a result of their physical health [r = 0.454, $p < 0.001$].

There is a very strong positive relationship between respondents having difficulty performing their work due to physical health (PW4) and (PW5) the amount of time they had to cut down on their work/activities because of their physical health [r = 0.731, $p < 0.001$].

The results indicate a weak positive relationship between getting sick easier than others (PW3) and having respiratory illnesses (PW9) [r = 0.283, $p < 0.001$]. There is a weak positive relationship between being diagnosed with high blood pressure and having

high blood sugar [r = .222, $p < 0.05$]. There is a weak positive relationship between having high cholesterol (PW7) and (PW8) being diabetic [r = 0.285, $p < 0.001$]. Moreover, the results show a weak positive relationship between having high cholesterol (PW7) and being diagnosed with respiratory illnesses (PW9) [r = 0.260, $p < 0.001$].

The relationship between having difficulty performing work due to physical health (PW4) and (PW1) having disabilities is a weak positive relationship [r = 0.232, $p < 0.05$]. The results show a weak positive relationship between having disabilities (PW1) and (PW7) having high cholesterol [r = 0.208, $p < 0.05$]. Moreover, having high cholesterol (PW7) has a weak positive relationship with PW2 (My health is excellent.) [r = 0.214, $p < 0.05$].

The results are almost consistent with those of 78 observations (explained earlier). After comparing the outcomes of both data sets (Tables 5.4 and 5.5), the following pairs of physical well-being measures were shown to be correlated at similar levels of significance ($p < 0.001$): PW1-PW3, PW1-PW2, PW1-PW5, PW3-PW2, PW4–PW3, PW3–PW5, PW4-PW5, and PW7-PW8. The PW4–PW1, PW8–PW6, are PW7-PW9 are positively correlated at the 5% significant level. Nonetheless, the data sets have different results in terms of significant levels. First, there is a weak negative correlation in BMI-PWI measures at the 5% significant level in the partial data set (n = 78), but the full data set does not depict any correlation between this pair. The PW6-BMI measures have a negative moderate correlation at the 1% significant level in the partial data set, but the correlation is at a 5% significant level in the full data set. Moreover, the full data set indicates a positive weak correlation in the PW1-PW7 well-being measures, while the partial data set lacks such a correlation.

The full data set shows a correlation between BMI-PW8[1], BMI-PW9[2], PW1-PW7, PW2-PW7, and PW3-PW7 at the 5% significant level. But the partial data set does show any correlations between the mentioned pairs. Finally, the full data set shows a weak relationship between the PW2-PW4 well-being measures, but the partial data set does not present such a correlation. On the other hand, the partial data set presents a correlation between the PW3-PW8 pair, but the full data set does not show that. Comparing the correlation results in both data sets indicates that utilizing more observations (full data set) has improved the power of the study.

[1] - The relationship is negligible [$r = -0.191$, $p < 0.05$].

[2] - The relationship is negligible [$r = -0.190$, $p < 0.05$].

Table 5.5: Spearman's Correlation Analysis of Physical Well-being Variables (Full Data Set)

	BMI	PW1	PW2	PW3	PW4	PW5	PW6	PW7	PW8
PW1	0.127								
N	109								
PW2	-0.163	.384**							
N	110	114							
PW3	-0.030	.300**	.534**						
N	110	114	117						
PW4	0.103	.232*	.266**	.331**					
N	110	114	116	116					
PW5	0.100	.333**	.336**	.454**	.731**				
N	107	112	114	114	113				
PW6	-.244*	-0.028	0.117	0.069	-0.028	-0.035			
N	109	113	114	114	113	112			
PW7	-0.126	.208*	.214*	.195*	0.036	0.170	0.158		
N	108	113	114	114	113	112	113		
PW8	-.191*	0.036	0.118	0.169	0.036	-0.085	.222*	.285**	
N	109	114	115	115	114	113	114	114	
PW9	-.190*	0.069	0.165	.283**	-0.108	0.056	0.160	.260**	0.128
N	108	113	115	115	114	113	113	113	114

**. Significant at the 1% level.
*. Significant at the 5% level.

PW1: Do you have any physical disabilities? Yes = 0, No = 1.
PW2: My health is excellent. Definitely true = 5, Mostly true = 4, Don't know = 3, Mostly false = 2, Definitely false = 1.
PW3: I seem to get sick a little easier than other people. Definitely true = 1, Mostly true = 2, Don't know = 3, Mostly false = 4, Definitely false = 5.
PW4: In the past two weeks, have you had difficulty performing your work or other activities as a result of your physical health? Yes = 0, No = 1.
PW5: In the past two weeks, have you cut down the amount of time you spent on work or other activities as result of your physical health? Yes = 0, No = 1.
PW6: Have you ever been diagnosed with hypertension (high blood pressure)? Yes = 0, No = 1.
PW7: Have you ever been diagnosed with hypercholesterolemia (high cholesterol)? Yes = 0, No = 1.
PW8: Have you ever been diagnosed with diabetes? Yes = 0, No = 1.
PW9: Have you ever been diagnosed with respiratory illnesses and diseases (e.g., asthma, chronic bronchitis, lung cancer, pneumonia, etc.)? Yes = 0, No = 1.

II Mental Well-being

There are six variables to measure mental well-being. Table 5.6 presents the results of the frequency distribution of five mental well-being variables, including respondents' tiredness, nervousness, depression, calmness, and being energetic in the last two weeks. Table 5.6 presents the results for 78 observations, and Table 5.7 exhibits the outcomes for the full data set. Three variables, MW1 (Have you felt too tired?), MW2 (Have you been a very nervous person?) and MW3 (Have you felt so down that nothing could cheer you up?) inquire about respondents' tiredness, nervousness, and depression, respectively. The responses are determined based on a 6-point Likert Scale.

The results show that 42.3% of respondents did not feel tired at all or it was a little bit of the time, and 34.6% felt tired some of the time (MW1). The results of the full data set (n = 113) indicate that 64% of respondents did not feel tired at all or were tired a little bit of the time. 13% mentioned having felt tired some of the time (n = 113). The majority of respondents (73.1%) did not feel very nervous. The result is consistent with that of the full data set (n = 114), where 72% of participants did not feel nervous. 11.5% of people (n = 78) replied being nervous most or a good bit of the time, which is consistent with the results of the full data set (12%). No one stated being nervous all of the time in the last two weeks (n = 78) and only one person stated to be nervous all of the time in the full data set (n = 114). The results show that more than half of the respondents did not feel depressed at all (55.1%), and 42.3% of participants did not usually feel sad. No one declared feeling depressed all or most of the time (Figure 5.7). The results are consistent with the full data set (n = 114), where 58% of the respondents did not feel depressed at all, 37.5% did not generally feel sad, and no one mentioned being sad all the time (Figure 5.8).

Table 5.6: Mental Well-being Measures (n = 78)

Responses	MW1		MW2		MW3		MW4		MW5	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
All of the time	1	1.3	0	0	0	0	1	1.3	4	5.1
Most of the time	4	5.1	4	5.1	0	0	36	46.2	24	30.8
A good bit of the time	13	16.7	5	6.4	2	2.6	21	26.9	18	23.1
Some of the time	27	34.6	12	15.4	9	11.5	17	21.8	16	20.5
A little bit of the time	23	29.5	27	34.6	24	30.8	2	2.6	13	16.7
None of the time	10	12.8	30	38.5	43	55.1	1	1.3	3	3.8

MW1: Have you felt too tired? All of the time = 1, Most of the time = 2, A good bit of the time = 3, Some of the time = 4, A little bit of the time = 5, None of the time = 6.

MW2: Have you been a very nervous person? All of the time = 1, Most of the time = 2, A good bit of the time = 3, Some of the time = 4, A little bit of the time = 5, None of the time = 6.

MW3: Have you felt so down in the dumps that nothing could cheer you up? All of the time = 1, Most of the time = 2, A good bit of the time = 3, Some of the time = 4, A little bit of the time = 5, None of the time = 6.

MW4: Have you felt calm and peaceful? All of the time=6, Most of the time=5, A good bit of the time = 4, Some of the time = 3, A little bit of the time = 2, None of the time = 1.

MW5: Did you have a lot of energy? All of the time = 6, Most of the time = 5, A good bit of the time = 4, Some of the time = 3, A little bit of the time = 2, None of the time = 1.

Table 5.7: Mental Well-being Measures (Full Data Set)

Responses	MW1 (n = 113)		MW2 (n = 114)		MW3 (n = 114)		MW4 (n = 113)		MW5 (n = 114)	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
All of the time	2	1.8	1	1.0	0	0	3	2.7	6	5.3
Most of the time	9	8.0	7	6.0	1	1.0	49	43.0	34	29.8
A good bit of the time	15	13.3	7	6.0	4	3.5	34	30.0	27	23.7
Some of the time	15	13.3	17	15.0	15	13.0	20	18	22	19.3
A little bit of the time	40	35.4	38	33.0	28	24.5	6	5.3	18	15.8
None of the time	32	28.3	44	39	66	58.0	1	1.0	7	6.1

MW1: Have you felt too tired? All of the time = 1, Most of the time = 2, A good bit of the time = 3, Some of the time = 4, A little bit of the time = 5, None of the time = 6.
MW2: Have you been a very nervous person? All of the time = 1, Most of the time = 2, A good bit of the time = 3, Some of the time = 4, A little bit of the time = 5, None of the time = 6.
MW3: Have you felt so down in the dumps that nothing could cheer you up? All of the time = 1, Most of the time = 2, A good bit of the time = 3, Some of the time = 4, A little bit of the time = 5, None of the time = 6.
MW4: Have you felt calm and peaceful? All of the time=6, Most of the time=5, A good bit of the time = 4, Some of the time = 3, A little bit of the time = 2, None of the time = 1.
MW5: Did you have a lot of energy? All of the time = 6, Most of the time = 5, A good bit of the time = 4, Some of the time = 3, A little bit of the time = 2, None of the time = 1.

The results of MW4 (Have you felt calm and peaceful?) and MW5 (Did you have a lot of energy?) questions in the partial data set (n = 78) indicate that 74.4% of respondents felt calm and peaceful, and 59% had a lot of energy. Those who did not feel calm or energetic most often made 3.9% and 20.5%, respectively (Figure 5.7). These results are in line with those of the full data set, where 76% of people reported feeling calm, and 59% had a lot of energy. 6% of the respondents stated not being energetic (Figure 5.8). The results of MW6 (Have you been on any prescribed medicine for depression or anxiety?) also indicate that 27% of respondents have been prescribed depression or anxiety medication (Figure 5.6). The results exceed the national average reported in 2018 and a nationally representative household survey of the U.S. civilian noninstitutionalized population 2019-2021. Between 2015-2018, 13.2% of American adults reported taking antidepressant medication (Brody, 2020). In 2021, more than 21% of adults received mental health treatments (e.g., prescription medication, counseling, or therapy from a mental health professional, or both) in one year (Terlizzi, 2022).

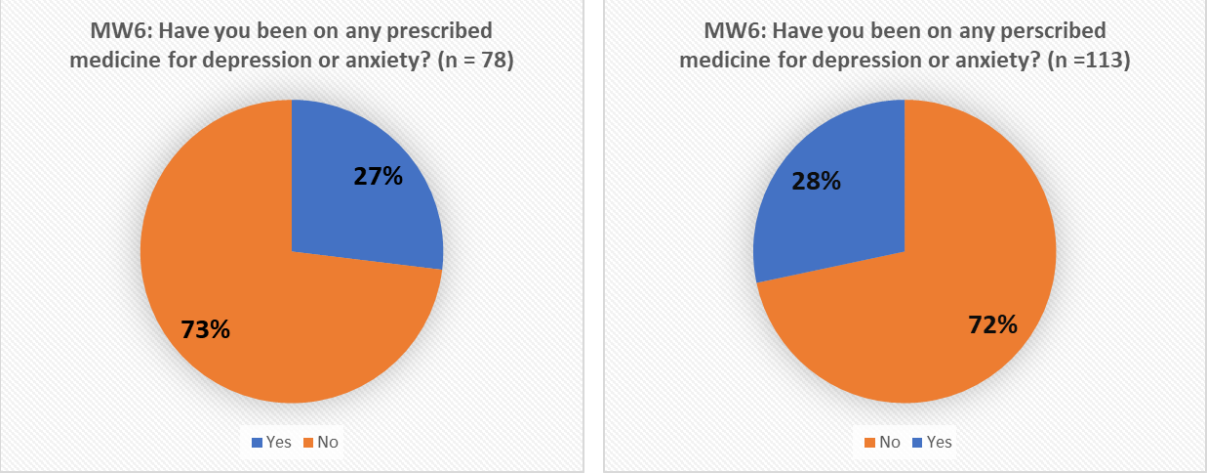


Figure 5.6: Percentage of Participants Taking Depression or Anxiety Medication

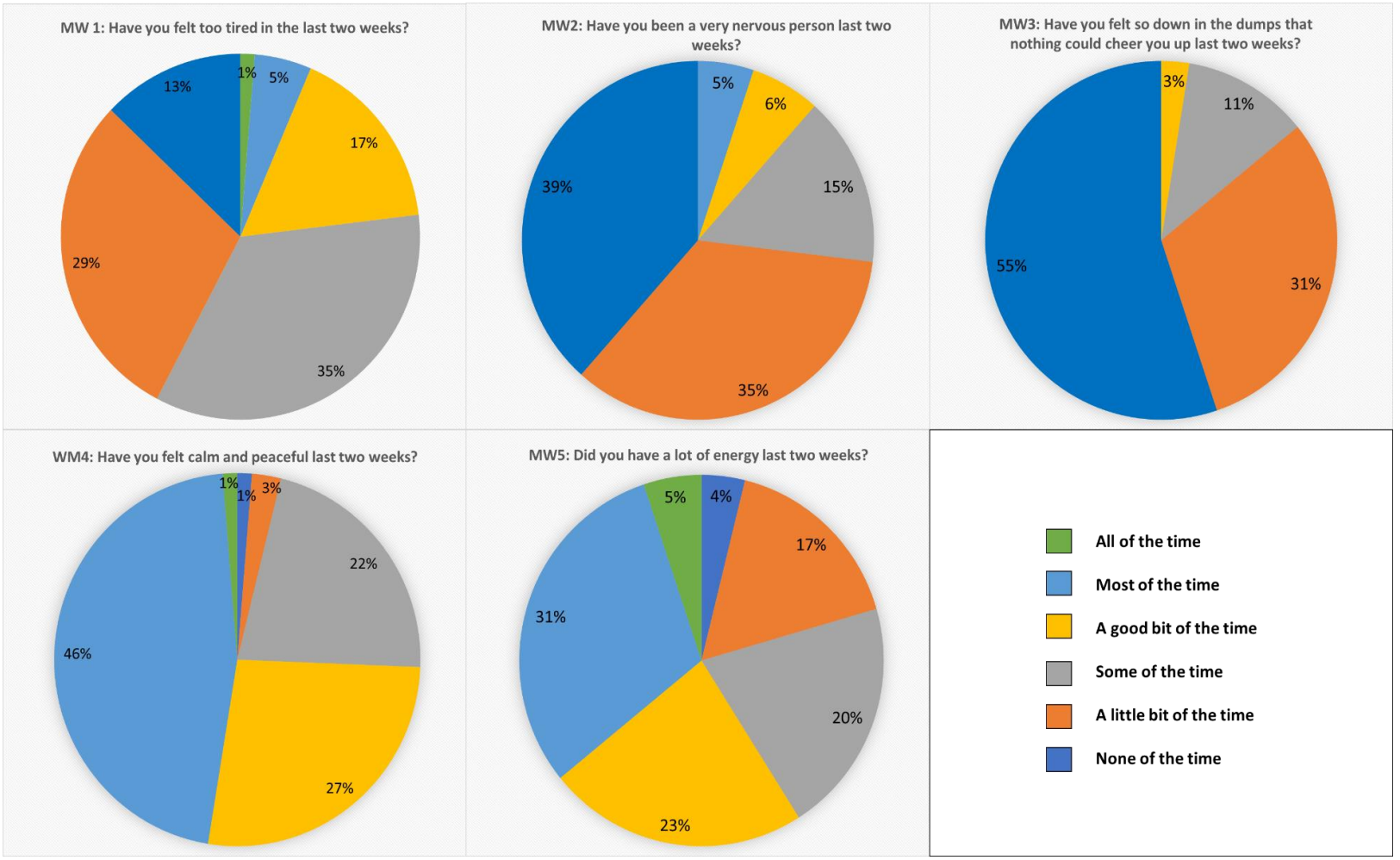


Figure 5.7: Mental Well-being Measures (n = 78)

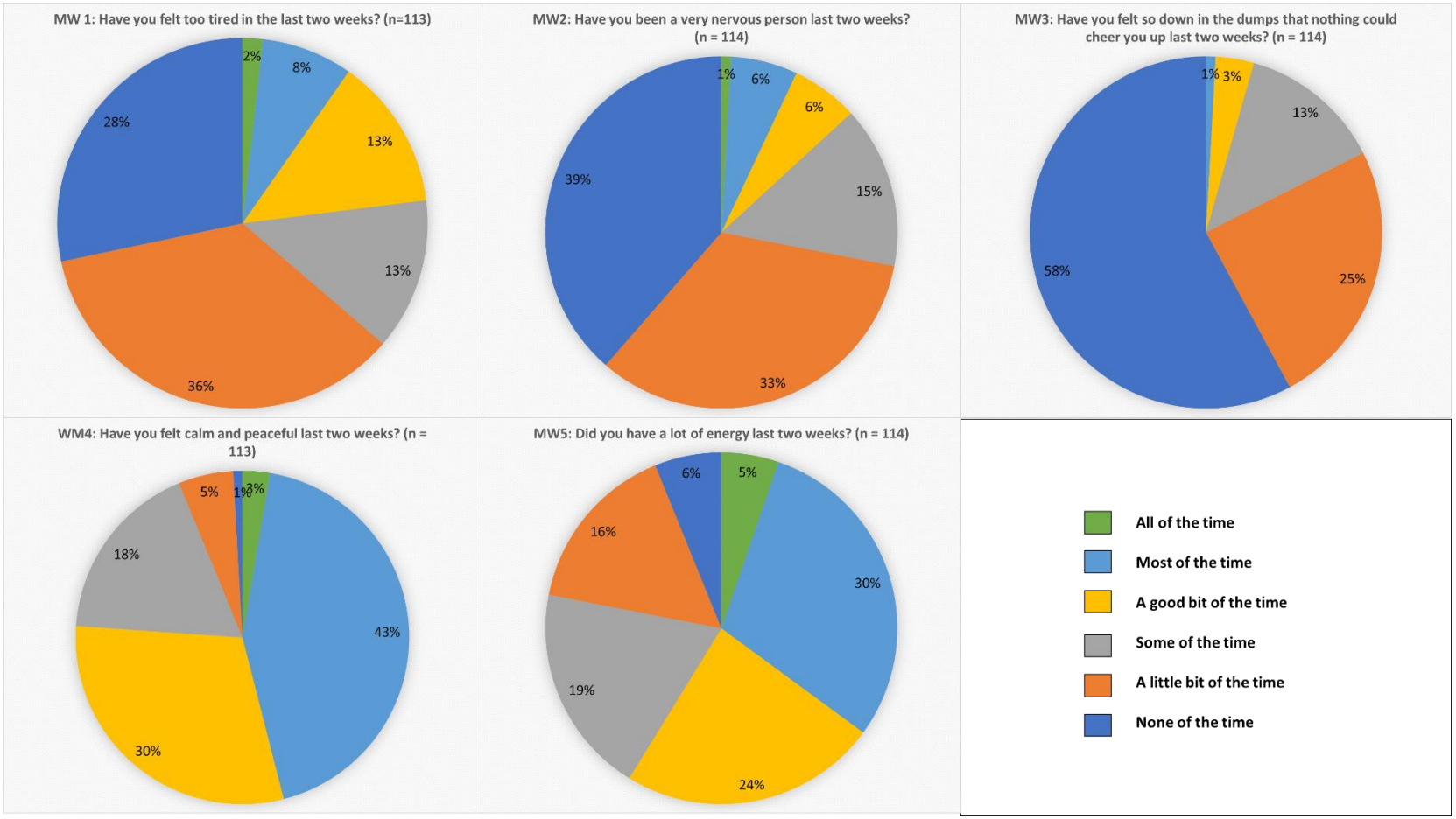


Figure 5.8: Mental Well-being Measures (Full Data Set)

Spearman's Correlation Analysis of Mental Well-being Measures (n = 78)

Table 5.8 presents Spearman's Correlation coefficients of mental well-being measures. The results indicate that there are strong positive correlations between respondents feeling too tired in the last two weeks (MW1) and them being nervous (MW2) [r = 0.554, $p < 0.001$], depressed (MW3) [r = 0.433, $p < 0.001$], not feeling peaceful (MW4) [r = 0.627, $p < 0.001$], or energetic (MW5) [r = 0.574, $p < 0.001$]. Twenty-one respondents (27%) took medicine for depression or anxiety. There was a statistically significant positive correlation between being very nervous (MW2) and depressed (MW3) [r = 0.450, $p < 0.001$], not feeling peaceful (MW4) [r = 0.512, $p < 0.001$], and taking anxiety medication (MW6) [r = 0.517, $p < 0.001$]. There was a week positive correlation between being nervous (MW2) and having a lot of energy (MW5) [r = 0.290, $p < 0.001$]. There are moderate positive and statistically significant correlations between being depressed (MW3) and feeling calm (MW4) [r = 0.392, $p < 0.001$] and taking anxiety medication (MW6) [r = 0.375, $p < 0.001$].

The results indicate that there are positive strong and statistically significant correlations between feeling calm (MW4) and having enough energy (MW5) [r = 0.452, $p < 0.001$] and taking medication for anxiety and depression (MW6) [r = 0.415, $p < 0.001$]. Moreover, there is a weak positive correlation between being depressed (MW3) and having enough energy [r = 0.289, $p < 0.05$]. Finally, there is a positive and weak correlation between having a lot of energy and taking anxiety medicine.

Table 5.8: Spearman's Correlation Analysis of Mental Well-being Variables (n = 78)

	MW1	MW2	MW3	MW4	MW5
MW2	.554**				
MW3	.433**	.450**			
MW4	.627**	.512**	.392**		
MW5	.574**	.290**	.289*	.452**	
MW6	.396**	.517**	.375**	.415**	.268*

**. Significant at the 1% level.
*. Significant at the 5% level.

MW1: Have you felt too tired? All of the time = 1, Most of the time = 2, A good bit of the time = 3, Some of the time = 4, A little bit of the time = 5, None of the time = 6.
MW2: Have you been a very nervous person? All of the time = 1, Most of the time = 2, A good bit of the time = 3, Some of the time = 4, A little bit of the time = 5, None of the time = 6.
MW3: Have you felt so down in the dumps that nothing could cheer you up? All of the time = 1, Most of the time = 2, A good bit of the time = 3, Some of the time = 4, A little bit of the time = 5, None of the time = 6.
MW4: Have you felt calm and peaceful? All of the time=6, Most of the time=5, A good bit of the time = 4, Some of the time = 3, A little bit of the time = 2, None of the time = 1.
MW5: Did you have a lot of energy? All of the time = 6, Most of the time = 5, A good bit of the time = 4, Some of the time = 3, A little bit of the time = 2, None of the time = 1.
MW6: Have you been on any prescribed medicine for depression or anxiety? Yes = 0, No = 1.

Spearman's Correlation Analysis of Mental Well-being Measures (Full Data Set)

Table 5.9 presents Spearman's Correlation coefficients of mental well-being measures using the full data set. The results are consistent with those of the partial data set (n = 78), nonetheless, the increase in the number of observations has augmented the coefficients, and all correlations are statistically significant at the 1% level ($p < 0.001$).

Table 5.9: Spearman's Correlation Analysis of Mental Well-being Variables (Full Data Set)

	MW1	MW2	MW3	MW4	MW5
MW2	.614**				
N	114				
MW3	.480**	.508**			
N	114	115			
MW4	.651**	.574**	.440**		
N	113	114	114		
MW5	.604**	.401**	.374**	.486**	
N	114	115	115	114	
MW6	.413**	.552**	.419**	.419**	.321**
N	112	113	113	112	113

**. Significant at the 1% level.

MW1: Have you felt too tired? All of the time = 1, Most of the time = 2, A good bit of the time = 3, Some of the time = 4, A little bit of the time = 5, None of the time = 6.
MW2: Have you been a very nervous person? All of the time = 1, Most of the time = 2, A good bit of the time = 3, Some of the time = 4, A little bit of the time = 5, None of the time = 6.
MW3: Have you felt so down in the dumps that nothing could cheer you up? All of the time = 1, Most of the time = 2, A good bit of the time = 3, Some of the time = 4, A little bit of the time = 5, None of the time = 6.
MW4: Have you felt calm and peaceful? All of the time = 6, Most of the time = 5, A good bit of the time = 4, Some of the time = 3, A little bit of the time = 2, None of the time = 1.
MW5: Did you have a lot of energy? All of the time = 6, Most of the time = 5, A good bit of the time = 4, Some of the time = 3, A little bit of the time = 2, None of the time = 1.
MW6: Have you been on any prescribed medicine for depression or anxiety? Yes = 0, No = 1.

III Social Well-Being

As for social well-being, the respondents were asked to rate (1) the amount of time they were not able to socialize with relatives or friends due to mental or physical problems, (2) whether they had social support, and (3) if they enjoyed attending parks and other public spaces to be around people and a part of the community. The responses to the first social well-being question (SW1) were rated based on a 5-point Likert scale (All of the time,

Most of the time, Some of the time, A little bit of the time, None of the Time).

Figure 5.9 illustrates the responses to social well-being inquiries in the partial (n = 78) and full data set, respectively. 63% of the respondents did not have physical or emotional problems that would have limited their social activities. The result is consistent with the full data set, where the majority of the respondents (66%) did not report limiting their social activities due to physical or emotional problems. In the partial data set (n = 78), 18% of the participants did not often socialize because of physical or mental health issues. The amount is 17% in the full data set (n = 114). 68% of respondents benefited from having social support in both data sets. 24% disagreed or strongly disagreed that they could find someone to accompany them (n = 78). The majority of the participants (70%) enjoyed attending parks for being part of the community in both data sets. On the other hand, 12% of respondents (strongly) disagreed that they visit parks to be around people in the partial and full data sets.

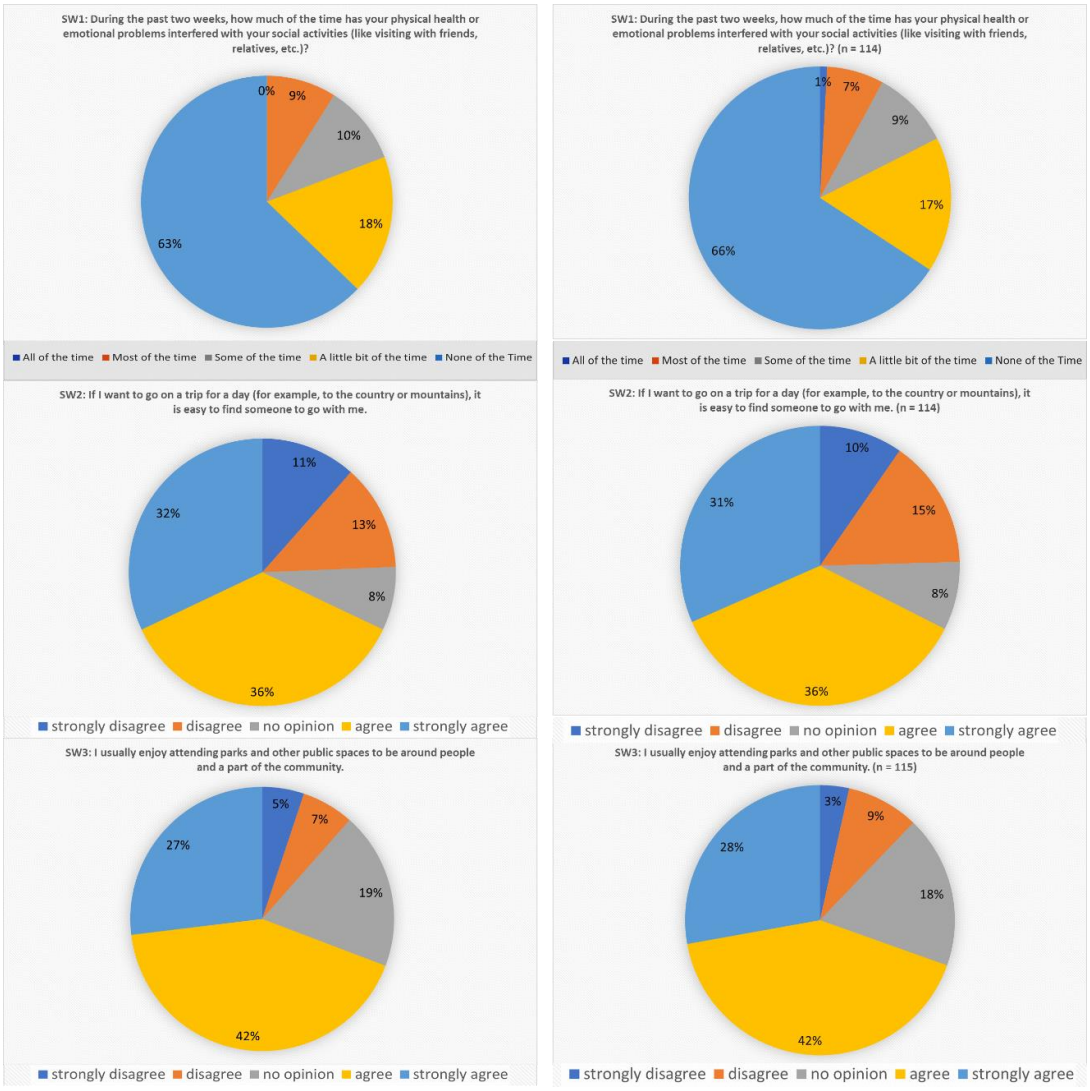


Figure 5.9: Social Well-being Measures in the Partial and Full Data Sets

Table 5.10 presents Spearman's Correlation coefficients of social well-being measures. It suggests a strong positive relationship between having social support (SW2) and using public spaces and parks to be a part of the community (SW3) [r = 0.415, p < 0.001]. There is a moderate positive correlation between the lack of ability to socialize with others (due to the respondent's physical or emotional well-being) and the lack of social support [r = 0.321, p < 0.001]. The results are consistent with the outcomes of the full data set (n = 115) (Table 5.11).

Table 5.10: Spearman's Correlation Analysis of Social Well-being Variables (n = 78)

	SW1	SW2
SW2	.321**	
SW3	-0.102	.415**

**. Significant at the 1% level.

SW1: How much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)? All of the time = 1, Most of the time = 2, Some of the time = 3, A little bit of the time = 4, None of the time = 5.
SW2: If I want to go on a trip for a day (for example, to the country or mountains), it is easy to find someone to go with me. Strongly agree = 5, Agree = 4, No opinion = 3, Disagree = 2, Strongly disagree = 1.
SW3: I usually enjoy attending parks and other public spaces to be around people and a part of the community. Strongly agree = 5, Agree = 4, No opinion = 3, Disagree = 2, Strongly disagree = 1.

Table 5.11: Spearman's Correlation Analysis of Social Well-being Variables (n = 115)

	SW1	SW2
SW2	.329**	
SW3	-0.034	.418**

**. Significant at the 1% level.

IV Principle Component Analyses of Well-being Indicators

Previous sections presented the high degree of correlation between measures of physical, mental, and social well-being variables in the partial (n = 78) and full data sets. However, conducting regression analyses by directly using all measures and variables would have made it difficult to provide meaningful interpretations. Therefore, Principal Component Analyses (PCA) were performed in SPSS to reduce the number of physical, mental, and social well-being variables. I used the partial data set (n = 78) to conduct the PCA. The partial data set is the clean data with no missing data.

Physical Well-being

The physical well-being variable includes nine indicators. The Kaiser-Meyer-Olkin

(KMO) statistic of sampling adequacy was 0.654, which indicated a medium level of adequacy. Bartlett's Test of Sphericity was significant (p = 0.00), indicating a substantial correlation in the data. Table 5.12 presents the results of the PCA analysis, including all dependent variables with a relatively high factor loading of 0.5 or greater (in absolute value). The results generated three components with Eigenvalue scores greater than one. The Eigenvalue scores of these components are 2.797, 1.582, and 1.011.

Table 5.12: PCA Analysis Component Matrix (Physical Well-being)

Variable	Component		
	1	2	3
PW3: Getting sick easier than others	.769	-.045	.068
PW5: Cutting down activities due to physical health	.725	-.416	.153
PW2: Excellent health status	.660	.013	-.535
PW1: Having disability	.593	-.271	-.413
PW4: Difficulty performing activities due to physical health	.519	-.567	.484
PW6: High blood pressure	.285	.519	.075
PW8: Having diabetes	.418	.512	.488
PW7: Having high cholesterol	.459	.511	.083
PW9: Having respiratory illness	.397	.469	-.202

According to Table 5.12, the first component contains five factors that load heavily on physical well-being indicators. Four of these factors load heavily on self-reported perceived health indicators, including getting sick easier than others (PW3), cutting down activities due to physical health (PW5), having an excellent health status (PW2), and lacking the ability to perform activities due to physical health (PW4). One factor loads heavily on the health outcome indicator of having disabilities (PW1). All factor loadings are positive, suggesting that high factor scores are associated with better perceived physical

well-being.

The second component includes four factors that load heavily for PW4 (having difficulty performing activities due to physical health). This indicator -representing self-reported perceived health- has a strong but negative factor loading. The second component contains loadings heavily influenced by four health outcome factors, including high blood pressure (PW6), diabetes (PW8), and high cholesterol (PW7). The third component contains one loading heavily influenced by self-reported perceived excellent health status (PW2). The factor loading is strong but negative for PW2.

Components one and two demonstrate high factor loadings among multiple variables that suggest they capture an important aspect of the interplay among the physical well-being measures. The third component illustrates a less clear relationship with an Eigenvalue score of 1.011 and it loads heavily only on one factor, self-reported perceived excellent health statuses (PW2). Accordingly, the third component will not be a good fit for the model and will be analyzed independently. The factor scores were used to serve as cumulative measures for the variables that loaded most heavily. Component one is named the *perceived health index (PHI)* since it represents all perceived health status. However, the disability factor (PW1) is a health outcome measure. The second component is named the *health outcome index (HOI)* due to representing three out of five health outcome measures such as high blood pressure (PW6), diabetes (PW8), and high cholesterol (PW7).

Mental Well-being

The mental well-being included six measures, five of which were used for conducting a Principal Component Analysis. The Kaiser-Meyer-Olkin (KMO) statistic of sampling adequacy was 0.784, which indicated a medium level of adequacy. Bartlett's Test

of Sphericity was significant (p = 0.00), indicating a substantial correlation in the data. Table 5.13 presents the results of the PCA analysis, including all mental well-being measures with a relatively high factor loading of 0.5 or greater (in absolute value). The results generated one component with an Eigenvalue score greater than one. The Eigenvalue score of this component is 2.863.

Table 5.13: PCA Analysis Component Matrix (Mental Well-being)

Variable	Component
	1
MW1: Feeling tired	.837
MW4: Being calm and peaceful	.819
MW2: Being nervous	.757
MW3: Being depressed	.682
MW5: Having a lot of energy	.673

The mental well-being component contains factors that all load on mental well-being indicators. Measures of mental well-being, including feeling tired (MW1), being calm (PW4), being nervous (MW2), being depressed (MW3), and having a lot of energy (MW5) have factor loadings greater than 0.6. This component is named the *mental well-being index (MWI),* which indicates respondents' levels of tiredness, peacefulness, nervousness, and depression.

Social Well-being

The social well-being included three indicators that two of which only had a statistically significant positive correlation [r = 0.403, $p < 0.001$], these two factors were used to conduct a PCA. The two indicators are having social support (SW2) and attending public spaces to enjoy being around people (SW3). The Kaiser-Meyer-Olkin (KMO)

statistic of sampling adequacy was 0.500, which indicated an acceptable level of adequacy. Bartlett's Test of Sphericity was significant (p = 0.00), indicating a substantial correlation in the data. Table 5.14 presents the results of the PCA analysis, including two social well-being measures with a relatively high factor loading of 0.5 or greater (in absolute value). The results generated one component with an Eigenvalue score greater than one. The Eigenvalue score of this component is 1.403. This component is named the *social well-being index (SWI)*, which describes having social support and vising the park as a means to meet their social needs.

Table 5.14: PCA Analysis Component Matrix (Social Well-being)

Variable	**Component**
	1
SW2: Having social support	.838
SW3: Attending public spaces to enjoy being around people	.838

V Correlations among Well-being Indices

Table 5.15 presents Pearson's Correlation coefficients of the four well-being indices, which were constructed based on PCA results. The correlation analyses indicate a strong positive correlation between the Mental Well-being Index (MWI) and the Perceived Health Index (PHI) [r = 0.534, $p < 0.001$]. The result aligns with other research showing that good mental health contributes to general health, and poor mental health has negative impacts on physical health (Contributors, 2021). For instance, poor mental health (e.g., depression) can cause pain. Having headaches, lacking enough energy, and feeling muscle and joint pain are some negative impacts on general health (Santos-Longhurst, 2019;

Contributors, 2021). There is also a weak positive correlation between the Social Well-being Index and the Health Outcome Index (HOI) [r = 0.295, $p < 0.001$]. Studies show that receiving and giving social support contribute to health indicators such as reducing blood pressure (Piferi, 2006; Amano, 2011; Rutledge, 2004).

Based on the results, there is not a statistically significant correlation between the health outcome index (HOI) and the perceived health index (PHI). However, one might expect that factors such as high blood pressure and cholesterol or being diabetic (representing the HOI in this research) have negative impacts on people's perceived health (e.g., not having an excellent health status or getting sick easier than others). One explanation can be taking medication to control blood pressure, cholesterol, or diabetes, which in turn helps people conduct their daily routines and feel confident about their general health.

Moreover, the results do not indicate a statistically significant correlation between the MWI and the HOI. But studies show that stress and anxiety can worsen HOI due to the close relationship between body and mind. While depression intensifies the risk for physical health issues (e.g., diabetes, heart disease, and stroke), chronic conditions can also augment the risk for mental illness (CDC, 2021; Contributors, 2021). Furthermore, chronic mental health conditions can lead to unhealthy habits (e.g., smoking or drinking) (Herbert, 1993).

The results do not show statistically significant correlations between the SWI and perceived health and mental well-being. But studies indicate that social wellness contributes to perceived health and mental well-being. For instance, Heinze et al. (2015) discovered that having social support (an indicator of social well-being) contributes to

better perceived health and mental well-being. Moreover, Krokavcova (2008) found that social well-being (having social support) is positively associated with perceived physical and mental health.

Table 5.15: Pearson Correlation Analysis between Well-being Indices

	PHI	HOI	MWI
HOI	.066		
MWI	.534**	.061	
SWI	.153	.295**	.217

**. Significant at the 1% level.

PHI: Perceived Health Index

HOI: Health Outcome Index

MWI: Mental Well-being Index

SWI: Social Well-being Index

VI Principal Component Analysis: Accessibility and Inclusion

The park accessibility variable had two measures: (Park's accessibility from the respondent's residence), and barriers (the presence of any physical barriers that limit people's access to the park). The inclusion variable included three measures: Gender Inclusion (GInclusion: If the park meets the needs of all genders), Age Inclusion (AInclusion: If the park meets the needs of all age groups), and Disabled people Inclusion (Disabled-Inclusion: If the park meets the needs of the disabled people). The Kaiser-Meyer-Olkin (KMO) statistic of sampling adequacy is 0.689, which indicated a medium level of adequacy. Bartlett's Test of Sphericity was significant (p = 0.00), indicating a substantial correlation in the data.

Table 5.16 presents the results of the PCA analysis, including all dependent variables with a relatively high factor loading of 0.5 or greater (in absolute value). The

results generated two components with Eigenvalue scores greater than one. The Eigenvalue scores of these components are 2.195 and 1.192.

Table 5.16: PCA Analysis Component Matrix (Accessibility and Inclusion)

Variable	Component	
	1	2
Accessibility		.662
Barriers		.804
GInclusion	.810	
AInclusion	.854	
Disabled-Inclusion	.771	

According to Table 5.16, the first component contains two factors that load heavily on accessibility indicators. Both measures of accessibility have factor loadings greater than 0.6. This component is named the *Accessibility Component* (AC), which indicates the degree of access to the park from respondents' residences. The second component includes three factors that all load heavily on inclusion indicators (gender, age, and disabled inclusion). All inclusion measures have factor loadings greater than 0.7. This component is named the *Inclusion Component* (IC), which represents the level of park inclusiveness. The correlation analyses indicated a weak positive correlation between the Accessibility and the Inclusion components [r = 0.204, $p < 0.1$]. Hence, the two factors were not consolidated.

VII Principal Component Analysis: Personal and Social Activities

The park-related activities include seven measures: (1) exercising, (2) people walking their dogs, (3) meditating, (4) socializing, (5) enjoying the natural environment, (6) mood improvement, and (7) attending social events. The Kaiser-Meyer-Olkin (KMO) statistic of sampling adequacy is 0.569, which indicated an acceptable level of adequacy.

Bartlett's Test of Sphericity was significant (p = 0.00), indicating a substantial correlation in the data.

Table 5.17 presents the results of the PCA analysis, including all dependent variables with a relatively high factor loading of 0.5 or greater (in absolute value). The results generated three components with Eigenvalue scores greater than one. The Eigenvalue scores of these components are 2.10, 1.311, and 1.234.

Table 5.17: PCA Analysis Component Matrix (Personal and Social Activities)

Variable	Component		
	1	2	3
Enjoying the natural environment	.739		
Mood improvement	.732		
Exercising	.632		
Meditating	.569		
Attending social events		.813	
Socializing		.628	
Walking my dog			.859

Based on Table 5.17, the first component contains four factors that load heavily on the individual activities' indicators (i.e., activities that can be conducted without a companion). All measures of personal activities have factor loadings greater than 0.5. This component is named the *Personal Interest Indicator* (PII), which indicates the activities that people might carry out without other people's presence. The second component includes two factors that all load heavily on socializing activities (socializing and attending social events). All socializing measures have factor loadings greater than 0.6. This component is named the *Social Interest Indicator* (SI), which represents the activities that cannot take place without others' presence or participation.

CHAPTER VI DEMOGRAPHIC ATTRIBUTES AND PARK USAGE ACTIVITIES

I Demographic Attributes

Eleven questions of the survey inquired about respondents' socio-economic status, including household size, gender, age, marital status, education, ethnicity, race, income, current employment status, housing type, and residential unit access to outdoor spaces (e.g., backyard, common outdoor areas, or balconies). The study area comprises three census tracts in Jefferson County (51, 52, and 66) (Bureau, 2021). In order to discover whether my study sample is representative of the population following tables provide the demographic attributes of the three census tracts. Moreover, I obtained the corresponding attributes for Jefferson County to assess how the study area differs from the rest of the city. Tables 6.1 to 6.5 provide the data for the partial and full data sets, the study area (census tracts 51, 52, and 66), and Jefferson County for every socio-economic data that was obtained from the study area.

According to Table 6.1, the most frequent household size is two people in the household (44.9%), followed by one person in the household (26.9%) in the partial data set. The average household size in the study sample is 4.2, which exceeds its counterparts in the study area (1.59), and the County (2.38). The difference is due to the presence of an outlier with 11 people in a household, while the majority of households in the study sample

had one or two members. However, household sizes with 1 or 2 people are the most common across census tracts and Jefferson County. The average household size in the full data set (n = 111) is consistent with its counterpart at the county level.

Table 6.1: Socio-economic Characteristics of Respondents (Study Sample, Study Area, and Jefferson County): Household Size

-	Study Sample (n = 78)		Study Sample (n = 111)		Study Area: Census Tracts 51, 52, 66		Jefferson County	
Household Size	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
1	21	26.9	30	27.0	1,407	45.5	107,957	32.6
2	35	44.9	49	44.1	877	28.4	116,522	35.2
3	15	19.2	20	18.0	412	11.3	47,442	14.3
4 or more	7	9.0	12	10.8	395	12.8	59,183	17.9
Average Household size	4.2		2.2		1.59		2.38	

Study Area and Jefferson County Source: U.S. Census Bureau (2021)

As shown in Table 6.2, more than half of the respondents (55%) were female, 44% were male, and 1% was other in both data sets. Men form 52.4% of the population in the study area and 49% of Jefferson County. The gender structure of the study sample is more similar to its counterpart at the city level. More than 60% of respondents were married in the partial and full data sets. Both data sets indicate that more than 15% of the respondents are divorced and 12.8% single, which is not representative of the population residing in the study samples. For instance, while 13% are single, the rate is 47% across the study area and 35% in Jefferson County.

Table 6.2: Socio-economic Characteristics: Gender and Marital Status

-	Study Sample (n = 78)		Study Sample (n = 118)		Study Area: Census Tracts 51, 52, 66		Jefferson County	
Gender	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
Male	34	44.0	52	44.0	4,151	52.4	371,306	49.0
Female	43	55.0	65	55.0	3769	47.6	397,113	51.0
Other	1	1.0	1	1.0	-	-	-	-
Marital Status	**Study Area (n = 78)**		**Study Area (n = 116)**					
Married	48	61.5	70	60.3	1,752	24.6	273,784	43.7
Single (Never married)	10	12.8	19	16.4	3,336	47	219,277	35.0
Widowed	6	7.7	8	6.9	583	8.2	40,096	6.4
Divorced	13	16.7	18	15.5	1240	17.4	81,446	13.0
Separated	1	1.3	1	0.9	207	2.8	11,904	1.9

Study Area and Jefferson County Source: U.S. Census Bureau (2021)

The mean and median age of participants was 53.41 and 55 years (n = 78), and 52.37 and 53 years (n = 113), respectively. The minimum and maximum ages in both data sets were 21 and 82 years, respectively (Table 6.3). People in two age groups (70-79 and 30-39) construct almost 40% of the respondents, while only 8% of the population in the study area and 6.6% in Jefferson County belong to this age group. Three age groups (40–49, 50-59, and 60-69) construct half of the population (53.1%) in the full data set.

Table 6.3: Socio-economic Characteristics of Respondents (Study Sample, Study Area, and Jefferson County): Age Structure

-	Study Sample (n = 78)		Study Sample (n = 113)		Study Area: Census Tracts 51, 52, 66		Jefferson County	
Age Structure	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
20-29	7	9.0	11	9.7	1,612	23.2	107,724	14
30-39	15	19.2	19	16.8	1,517	19.4	104,148	13.5
40-49	9	11.5	20	17.7	794	11.4	93,541	12.1
50-59	14	17.9	20	17.7	1093	15.7	100,501	13.1
60-69	14	17.9	20	17.7	1193	17.1	93,034	12.1
70-79	16	20.5	18	15.9	555	8	50,770	6.6
80-89	3	3.8	5	4.4	365	5.2	30,752	4

Study Area and Jefferson County Source: U.S. Census Bureau (2021)

None of the participants were Hispanic, Latino, or Spanish in the partial data set. After considering the observations with the missing data, the results indicated that 2% of the respondents were Hispanic/Latino. Even though the rate is lower than its counterparts at the study area (4.5%) and Jefferson County levels (7.5%), the full data set is more representative of the Hispanic population than the partial data set. More than 90% of respondents were white in both data sets. More than 6.0% of the participants were Black, African American, and almost 3% were from some other races in both data sets (Table 6.4). However, according to Table 6.4, only 61% of the study area is white, 27.3% are African American, and 11.7% are from other races. The race characteristic of the sample population also differs from the 64% white population of Jefferson County.

Table 6.4: Socio-economic Characteristics of Respondents (Study Sample, Study Area, and Jefferson County): Race and Ethnicity

-	**Study Sample (n = 78)**		**Study Sample (n = 117)**		**Study Area: Census Tracts 51, 52, 66**		**Jefferson County**	
Race	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
Black, African American	5	6.4	8	6.8	2,302	27.3	168,910	21.6
Some Other Race	2	2.6	4	3.4	984	11.7	114191	14.4
White	71	91	105	89.7	5,134	61.0	499,868	64.0
Ethnicity	**Study Sample (n = 78)**		**Study Sample (n = 117)**					
	Frequency	**Percent**	**Frequency**	**Percent**				
Hispanic, Latino, Spanish	0	0	2	2.0	377	4.5	59,021	7.5
Non-Hispanic, Latino, Spanish Origin	78	100	115	98.0	8,044	95.5	723,948	92.5

Study Area and Jefferson County Source: U.S. Census Bureau (2021)

More than half of the respondents (62.7% in the partial and 60% in the full data sets) earned more than $75,000, which was more than $58,357 -the median household income in Louisville in 2021, according to the US Census Bureau (Bureau, QuickFacts, 2022) (Table 6.5). However, the sample population is representative of the population, and the income and education attributes deviate enormously compared to the study area and the County's corresponding attributes. For instance, almost 20% of respondents have an annual income of $200,000 or more in both data sets; however, only 5.7% of the County's residents belong to this category. The income is not representative of the income attributes of the study area. Moreover, almost 80% of respondents had a bachelor's degree or higher in both data sets, and 14 to 15% had some college or associate degree. The percentage of the population who possess a bachelor's degree or higher in the study area and the County are 33.5 and 31.8, respectively.

Table 6.5: Socio-economic Characteristics of Respondents (Study Sample, Study Area, and Jefferson County): Income and Education

-	Study Sample (n = 78)		Study Sample (n = 113)		Census Tract 51		Census Tract 52		Census Tract 66		Jefferson County	
Income	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
Less than $10,000	5	6.4	8	7.1	-	27.5	-	10.7	-	7.1	-	6.5
$10,000 to $14,999	5	6.4	5	4.4	-	11.1	-	8.5	-	4.2	-	4.4
$15,000 to $24,999	4	5.1	8	7.1	-	12.3	-	18.7	-	16.0	-	8.8
$25,000 to $34,999	2	2.6	3	2.7	-	17.8	-	17.0	-	16.7	-	9.8
$35,000 to $49,999	2	2.6	4	3.5	-	9.3	-	10.9	-	21.2	-	13.5
$50,000 to $74,999	10	12.8	17	15.0	-	6.4	-	8.9	-	8.2	-	18.7
$75,000 to $99,999	9	11.5	13	11.5	-	6.7	-	7.2	-	8.0	-	12.7
$100,000 to $149,999	14	17.9	17	15.0	-	6.4	-	13.0	-	14.0	-	14.1
$150,000 to $199,999	11	14.1	17	15.0	-	1.5	-	2.4	-	3.9	-	6.0
$200,000 or more	16	20.5	21	18.6	-	1.1	-	2.6	-	0.7	-	5.7
Education	**Study Sample (n = 78)**		**Study Sample (n = 117)**		**Study Area: Census Tracts 51, 52,66**						**Jefferson County**	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**		**Percent**				**Frequency**	**Percent**
Less than high school graduate	0	0	1	0.9	613		9				56,554	9.5
High school graduate	3	3.8	7	6.0	1,564		22.3				161,593	27.0
Some college or associate degree	12	15.4	16	13.7	2,498		35.6				190,212	31.8
Bachelor's degree or higher	63	80.8	93	79.5	2,350		33.5				189,995	31.8

Study Area and Jefferson County Source: U.S. Census Bureau (2021)

According to Tables 6.2 to 6.5, the sample does not represent the lower-income, less-educated, younger, and unmarried population which is African American or from a Hispanic origin. Although this study benefited from a 100%-household survey to avoid sampling bias, it suffers from a self-selection bias since it is biased towards those who volunteered to participate in the research. In this study, the sample is biased toward the white, older, and married population, which does not include any respondents of Hispanic origin. Moreover, it is biased towards the upper-middle class (e.g., earning annual income higher than the median household income in Louisville and possessing higher education degrees). Accordingly, the biased sample causes skewed results and threatens the external validity of the findings, which in turn, limits the ability to provide generalizable results. Table 6.6 shows that more than half of the respondents were employed full-time, followed by the number of retired participants in both data sets.

Table 6.6: Socio-economic Characteristics of Respondents: Employment Status

Employment Status	**Study Sample (n = 78)**		**Study Sample (n = 117)**	
	Frequency	**Percent**	**Frequency**	**Percent**
Employed Full-Time	42	53.8	64	54.7
Employed Part-Time	14	17.9	17	14.5
Not ready to enter the job market	1	1.3	3	2.6
Retired	20	25.6	32	27.4
Seeking opportunities	1	1.3	1	0.9

As shown in Table 6.7, the majority of respondents (almost 70%) lived in single-family homes, 15% in apartments, 9.0% in senior housing, and more than 6% in multi-family houses in both data sets. Only 5.1% of the respondents' residences did not have outdoor areas (e.g., backyards, common outdoor areas, or balconies). This implies that Central Park is the only outdoor recreational area for those residents.

Table 6.7: Socio-economic Characteristics of Respondents: Housing Attributes

	Study Sample (n = 78)		Study Sample (n = 116)	
	Frequency	**Percent**	**Frequency**	**Percent**
Housing Type				
Apartment	12	15.4	17	14.7
Multi-family house	6	7.7	7	6.0
Senior Housing	7	9	10	8.6
Single-family house	53	67.9	82	70.7
Housing Outdoor Space	**Study Sample (n = 78)**		**Study Sample (n = 117)**	
Yes	74	94.9	109	93.0
No	4	5.1	8	7.0

II Park Usage

The park usage was assessed by asking seven questions about the usage frequency, usage duration, usage regularity, respondents' transportation modes to the park, preferred time to visit the park, subjective distance to the park, and their reasons for visiting the park. Table 6.8 presents the park usage. In the partial data set (n = 78), 30.8% of the respondents visited the park once or more times/week, followed by one or more times/month (28.2%), and less than once/month. Only 16.7% visited the park on daily bases. The results are consistent with those of the full data set. 39% of the respondents spent 15-30 minutes in the park, followed by 24% who stayed up to one hour, and 19% -who visited the park for less than 15 minutes. 18% of the respondents spent more than one hour in the park. These results are in line with those of the full data set (n =116).

People visit the park at their convenience, and the results show that 23.1% of the participants visited the park only during their spare time, followed by 19% on weekends, 16.7% during the week, and 7.7% on special occasions. Others used the park on various occasions. The results are consistent with the full data set (n = 117). More than half of the

respondents preferred to visit the park sometime from afternoon to evening and night in both data sets. 11.5% of the park users spent time there in the morning, 5.1% in the morning, and the rest of the people did not have a regular (preferred) time (n = 78).

Table 6.8: Park Usage Patterns: Frequency, Duration, and Regularity

Park Usage	**Study Sample (n = 78)**		**Study Sample (n = 116)**	
	Frequency	**Percent**	**Frequency**	**Percent**
Frequency				
Once or more times/week	24	30.8	39	33.6
Once or more times/month	22	28.2	31	26.7
Less than once/month	19	24.4	25	21.6
Daily	13	16.7	21	18.1
Duration	**Study Area (n = 78)**		**Study Area (n = 116)**	
15 to 30 minutes	30	39.0	48	41.4
Up to one hour	19	24.0	30	25.9
Less than 15 minutes	15	19.0	21	18.0
More than one hour	14	18.0	17	14.7
Regularity	**Study Area (n = 78)**		**Study Area (n = 117)**	
Special occasions	6	7.7	8	7.0
Weekdays	13	16.7	21	17.9
Weekends	15	19.0	21	17.9
During my spare time	18	23.1	28	23.9
All of the above	26	33.5	39	33.3
Preferred Time	**Study Area (n = 78)**		**Study Area (n = 117)**	
Afternoon, Evening, Night	49	62.9	67	57.3
Any time	16	20.5	26	22.2
Morning	9	11.5	18	15.4
Noon	4	5.1	6	5.1

Most respondents (89.7%) walked to the park, and no one took the bus to get there. Most park visitors (89.7%) get to the park in less than 15 minutes. 10.3% spent between 16 to 30 minutes to get to the park. Except for 9.1% of people who visited the park for a single reason -exercising (1.3%), walking their dogs (2.6%), socializing (1.3%), enjoying the natural environment (2.6%), and enhancing their mood (1.3%)- other respondents (90.9%) visited for multiple reasons (Table 6.9). Table 6.9 indicates that the results of both

data sets are consistent.

Table 6.9: Means of Access and Reasons to Visit the Park

	Study Sample (n = 78)		Study Sample (n = 117)	
	Frequency	**Percent**	**Frequency**	**Percent**
Transportation Mode				
I walk to the park	70	89.7	104	89.0
I use my personal vehicle	5	6.4	9	8.0
I bike or use my scooter/wheelchair	3	3.8	4	3.0
Distance to the Park	**Study Sample (n = 78)**		**Study Sample (n = 115)**	
Between 6 to 15 minutes	37	47.4	59	51.0
Less than five minutes	33	42.3	46	40.0
Between 16 to 30 minutes	8	10.3	10	9.0
Reasons to Visit the Park	**Study Sample (n = 78)**		**Study Sample (n = 118)**	
To meditate	0	0.0	0	0.0
To attend social events	0	0.0	1	0.8
To exercise	1	1.3	1	0.8
To socialize	1	1.3	1	0.8
To improve my mood	1	1.3	1	0.8
To walk my dog	2	2.6	5	4.2
To enjoy the natural environment	2	2.6	2	1.7
Some/All of the Above	71	90.9	107	90.7

III Perceived Park Quality

To assess people's perception of the park's quality, I inquired about its accessibility, inclusiveness, satisfaction with the park's management, amenities, recreation facilities, safety, and comfortable areas. There are two accessibility questions to assess: a) the accessibility to the park from one's residence and b) the presence of physical barriers that limit access to the park. The first question refers to subjective access to the park, and responses were based on a 5-point Likert scale (very poor, poor, fair, good, and excellent). The second question had a yes-no option.

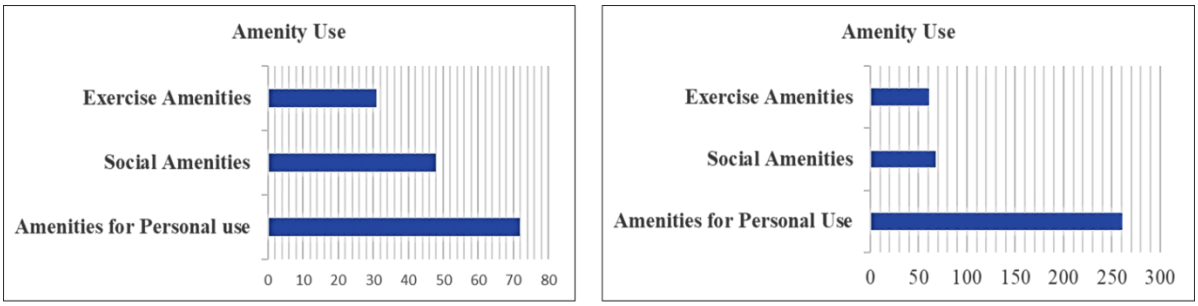
Table 6.10 presents how respondents assess park quality. Park accessibility was excellent for More than half of the respondents (59%), followed by 38.5% with good

access, and 2.6% with fair access to the park. The major difference between the partial and full data sets is due to the 3% of respondents who claimed to have poor access to the park (n = 117). 6.4% faced physical barriers that would limit their access to the park (e.g., lack of ramps for those using a wheelchair, broken pavements, or any ditches that made it difficult to access the park on rainy days). The former rate doubles in the full data set, where 14% of people stated facing physical barriers on their way to the parks. 93.6% of respondents could access the park without facing any physical barriers.

Most respondents (80.8%) stated that the park met the needs of all gender, but only half of the participants (57.7%) perceived the park to meet the needs of all age groups. Less than half of the respondents (43.6%) thought that the park met the needs of disabled people. 28.2% of the participants were not satisfied with the park's physical conditions, maintenance, and management. 24.4% were not satisfied with the park's recreation facilities. Respondents were asked to rate how they perceived the park's safety during the daytime and after dark after the COVID-19 pandemic. 65.4% felt no change in the park's safety during the daytime, followed by 20.5% who perceived the park as being safer after the pandemic. Nonetheless, 14.1% felt the park's safety decreased after the pandemic. 50% perceived no change in the park's safety after dark, followed by 29.4% who felt the park's safety after dark had increased compared to dark time safety before the pandemic. On the other hand, 20.5% of participants believed that the park's safety after dark has decreased. According to Table 6.10, the results of both data sets are consistent.

Park amenities were classified into three groups: (1) amenities for personal use, (2) social events amenities, and (3) exercise amenities. The first group consists of amenities that can be used individually or in the group (e.g., walkways, benches, picnic tables, and

tree shades during hot seasons). People can use these amenities not just for work-out. The second category is the amphitheater, used during social events (e.g., Shakespeare Festival). The third group includes the tennis court, volleyball field, spray, and playgrounds that are used for physical activities and exercise. All amenities were appreciated and used by respondents; however, the usage varied across participants. The most mentioned amenities were from the first group, including the benches, walkways, tree shades, and picnic tables. 92% of respondents named at least one amenity for personal use. Forty-eight respondents (61.5%) mentioned using the amphitheater. 40% of participants (41 people) used at least one type of the park's exercise amenities (Figure 6.1).



N = 78 Full Data Set

Figure 6.1: Most-Used Park Amenities in Partial and Full Data Sets

Table 6.10: Park Quality

Park's Quality	Study Sample (n = 78)		Study Sample (n = 117)	
	Frequency	Percent	Frequency	Percent
Accessibility				
Excellent	46	59	66	56.4
Good	30	38.5	42	35.9
Fair	2	2.6	6	5.1
Poor	0	0.0	3	2.6
Physical Barriers	**Study Sample (n = 78)**		**Study Sample (n = 117)**	
No	73	93.6	101	86.3
Yes	5	6.4	16	13.7
Inclusion-Gender	**Study Sample (n = 78)**		**Study Sample (n = 115)**	
No	6	7.7	9	8.0
Somewhat	9	11.5	13	11.0
Yes	63	80.8	93	81.0
Inclusion-Age	**Study Sample (n = 78)**		**Study Sample (n = 114)**	
No	14	17.9	22	19.0
Somewhat	19	24.4	26	23.0
Yes	45	57.7	66	58.0
Inclusion-Disabled People	**Study Sample (n = 78)**		**Study Sample (n = 113)**	
No	13	16.7	22	19.0
Somewhat	31	39.7	40	35.0
Yes	34	43.6	51	46.0
Satisfaction with the park's maintenance and management	**Study Sample (n = 78)**		**Study Sample (n = 117)**	
No	22	28.2	38	32.0
Somewhat	32	41.0	44	38.0
Yes	24	30.8	35	30.0
Satisfaction with the park's recreation facilities	**Study Sample (n = 78)**		**Study Sample (n = 112)**	
No	19	24.4	32	29.0
Somewhat	29	37.2	38	34.0
Yes	30	38.5	42	37.0

Table 6.10: Park Quality (Cont.)

Park's Quality	Study Sample (n = 78)		Study Sample (n = 117)	
	Frequency	Percent	Frequency	Percent
Park's Safety Daytime				
Decreased a little	2	2.6	6	5.0
Decreased a lot	5	6.4	8	7.0
Decreased moderately	4	5.1	6	5.0
Increased a little	8	10.3	9	8.0
Increased a lot	4	5.1	4	3.0
Increased somewhat	4	5.1	5	4.0
No change	51	65.4	79	68.0
Park's Safety After Dark	**Study Sample (n = 78)**		**Study Sample (n = 114)**	
Decreased a little	6	7.7	9	8.0
Decreased a lot	5	6.4	11	10.0
Decreased moderately	5	6.4	5	4.0
Increased a little	4	5.1	6	5.0
Increased a lot	9	11.5	12	10.5
Increased somewhat	10	12.8	11	10.0
No change	39	50	60	52.5
Comfortable Places and Amenities	**Study Sample (n = 78)**		**Study Sample (Full data set)**	
Seats/Benches	54	--	73	--
Amphitheater	48	--	68	--
Picnic Tables	32	--	38	--
Playground	18	--	25	--
Restrooms	18	--	21	--
Spray Ground	4	--	8	--
Tennis Court	19	--	24	--
Volleyball Field	3	--	4	--
Walkways	51	--	70	--
Comfortable environment during hot seasons (e.g., shade and shelter)	43	--	59	--

CHAPTER VII REGRESSION RESULTS

I utilized the Principal Component Analysis (PCA) to reduce the number of physical, mental, and social well-being variables. The final PCA results provided four dependent variables. The Perceived Health Index (PHI) reflects respondents' general health status (e.g., cutting down activities due to physical health issues). The Health Outcome Index (HOI) represents the physical well-being status referring to the respondent's high blood pressure, diabetes, high cholesterol, and being diagnosed with any respiratory illnesses. The Mental Well-being Index (MWI) and Social Well-being Index (SWI) refer to the respondents' mental and social well-being statuses.

Another PCA designated two sets of indicators representing the independent variables: (1) the Personal Interest Index (PII, including activities such as exercise, meditation, enjoying the natural environment, and visiting the park for mood improvement) and (2) the Socializing Index (SI, representing socializing and attending social events). The PII indicates activities that individuals perform based on their personal interests, with or without accompanying others. On the other hand, the SI refers to park usage activities that require the presence of other people.

The park's accessibility component (AC) represents (1) participants' accessibility to the park (Very poor=1, Excellent= 5) and (2) the presence of any physical barriers that limit park access (e.g., lack of ramps for people on wheelchairs).

To investigate the relationships between independent (park usage Frequency, PII, SI, and AC) and control variables (Age, Gender, and Income), and dependent variables (PHI, HOI, MWI, and SWI), I utilized four multiple linear regression models. The general multiple linear regression models have been explained in Chapter III.

Linear Regression Results

Four empirical models are performed to assess the association between variables (Chapter III). Table 7.1 presents the linear regression results for the first empirical model.

Table 7.1: Results of Multiple Linear Regression (Model 1)

	The Perceived Health Index (PHI)		**The Health Outcome Index (HOI)**		**The Mental Well-being Index (MWI)**		**The Social Well-being Index (SWI)**	
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
(Constant)	4.770	.003	1.513	.002	12.498	.000	7.514	.000
Frequency	.173	.618	.103	.317	.661	.331	-.429	.191
PII	-.062	.597	-.028	.419	-.007	.975	.046	.678
SI	-.117	.519	.069	.200	.399	.261	**.632**	**.000*****
AC	.118	.767	.015	.899	-.317	.684	-.608	.109
Gender	**-.666**	**.074***	.066	.547	**-1.606**	**.028****	-.168	.628
Age	.017	.142	**-.010**	**.005*****	**.068**	**.003*****	**-.020**	**.068***
Income	**.259**	**.000*****	.004	.829	**.292**	**.027****	**.188**	**.004*****
R^2	0.215		0.164		0.213		0.417	

***. Significant at the 1% level.
**. Significant at the 5% level.
*. Significant at the 10% level.

According to the existing literature, frequent park usage is associated with better perceived health (Schnell, 2019; Romagosa, 2018; Carter, 2014; Epstein, 2012; Almanza, 2012; Zhang L. Y., 2022; Enssle, 2020) and improves health outcomes (Yeager R. R.,

2018; Riggs, 2021; Su, 2016). In contrast to my expectations, this model did not provide evidence to support my hypothesis, which expected that frequent park visit has a significant impact on the physical, mental, and social well-being of park users. Model 1 indicates that frequency has positive impacts on the PHI and the HOI; however, these impacts are not statistically significant. One reason that might justify the insignificant impact of frequent park usage on the PHI and HOI is that the majority of respondents have reported good PHI and HOI statuses. For instance, 85.9% of respondents perceived their general health as excellent or very well, and 68% stated that they did not get sick easier than others.

Even though studies indicate that frequency has a significant positive impact on mental well-being (Yigitcanlar, 2020; Yuen, 2020; Hazer, 2018; Zhou, 2022), Model 1 shows a positive insignificant impact on the MWI. The insignificant association between frequent park usage and the MWI might be due to the existing mental conditions of the sample population. For instance, the majority of respondents were not nervous (73.1%) or depressed (55.1%). Moreover, most participants felt calm (74.4%) and 59% had a lot of energy. Finally, only one-fourth of the sample population was prescribed depression or anxiety medicine.

Research on green space usage and social well-being shows the positive and statistically significant between the two, where public green spaces provide interaction opportunities, develop new social ties among members, and fortify the existing relationships among neighbors (Kaźmierczak, 2013; Burgess, 2021). However, the negative impact of frequency on the SWI -although insignificant- indicates that Model 1 does not support the hypothesis. The data shows that more than half of the sample population had social support (68%) and attended Central Park for socializing (69%), a

possible explanation can be that only half of the respondents (52.6%) used the park frequently (e.g., daily, or more than once a week). Moreover, people's intention to use the park for socializing can change the impact.

While the literature suggests that park-based activities have a significant positive impact on PHI and HOI by decreasing cardiovascular risk, systolic blood pressure, the BMI, and increasing cardiovascular health (Modesto, 2021; Kling, 2018), Model 1 shows that the PII has insignificant negative impacts on the PHI, the HOI, and the MWI. The explanation for the negative impact -although insignificant- of the PII on the PHI and HOI might be due to the lack of categorized park usage data. For instance, the park usage pattern for exercising only pertains to 1.3% of respondents. No one uses the park just for meditation. Yet, 91% of the sample population uses Central Park for multiple reasons.

The negative impact of PII on the MWI is surprising, yet the literature suggests mixed results, as well. For instance, Moreira (2013) discovered that people with less physical activity in parks tend to have a higher stress level. On the other hand, Richardson et al. (2013) and Sturm et al. (2014) found that park-based physical activity may not be the main pathway that establishes a link between green space and mental well-being. The data show that no one uses the park exclusively for meditation but rather for a combination of park-based activities. The lack of discrete data might be the justification for the negative insignificant impact of the PII on the MWI.

The positive impact of PII on the SWI is not significant in this model. While the literature recommends that activities in urban parks contribute to the formation of informal and social interactions, which are necessary for a healthy lifestyle (Paul, 2022), the PII - represents park usage for personal interest, such as exercising, meditation, and mood

improvement- is not in line with an individual's social needs.

While, there are indications of socializing activities in parks that contribute to people's general health (Francis J. G.-C., 2012 a), According to Model 1, the SI has a negative insignificant impact on the PHI. The SI indicates park usage for social activities, which logically is less likely to contribute to the perceived health index, including issues such as difficulty performing activities due to physical health problems or having a disability. Moreover, the SI has a positive -but insignificant- impact on the HOI and MWI. According to Maas et al. (2009), public parks can contribute to mental well-being by increasing social interaction and alleviating the sense of loneliness and lack of social support among people. The model shows that SI has a statistically significant positive impact on the SWI. Accordingly, 1 unit change in the SI will cause a 0.632-unit change in the SWI. This result is in line with the literature, suggesting that participating in park-based social activities has a significant positive impact on social well-being (Baur, 2013; Burgess, 2021).

The literature indicates no conclusive results in terms of accessibility and various aspects of well-being. For instance, Larson et al. (2016) did not find a relationship between park accessibility and well-being. (Maas J. V., 2006) disputed the association between urban park accessibility and physical activity. The authors stated that the availability of green spaces does not guarantee physical activity. Moreover, Zhang et al. (2022) did not discover a significant association between access to greenness and mental well-being. On the other hand, other empirical studies suggest that the high availability of accessible urban parks is significantly contributing to residents' well-being (Zhang Y. v., 2015). For instance, exposure to green space promotes cardiovascular health by reducing air pollution,

enhancing mental capacities such as stress recovery and anxiety reduction, or encouraging physical activity (Yeager R. R., 2018; Riggs, 2021). Model 1 suggests that AC has an insignificant positive impact on the PHI and HOI and a negative impact on the MWI and the SWI. One reason that contributes to such inconsistency can be various ways of measuring accessibility. For instance, accessibility is measured by 1) the distance from one's residence to a park, 2) the subjective distance (how long it talks for a person to get to a park), 3) visual access (e.g., clear entrance), 4) the number of barriers to access the place, 5) the operating hours of public space or 6) the percentage of people living in a community with access to a public park (Ayala-Azcárraga, 2019; Ramlee, 2018; Villanueva, 2015; Lee A. C., 2015; Cilliers, 2015). The Center for Disease Control and Prevention (CDC) uses a half-a-mile distance to a park and the percentage of the people living within this distance in community design content to measure park accessibility (CDC, 2015). This research considers how people assess the park's accessibility from their homes (Excellent =5 and Very Poor = 1) and the presence of physical barriers. People have visual access to Central Park from all sides and it does not have a closing hour.

The negative impact of AC on the SWI contrasts with the findings of Baur et al. (2013). Their study concluded that park proximity has a significant positive impact on community social well-being whether people use them or not. One explanation for such a negative impact might be due to the questionnaire structure of the current study. The results of park usage show that only 1.3% and 0% of respondents use the park merely for socializing or attending social events, respectively. On the other hand, 91% of people use the park for a combination of all reasons (personal interests and socializing).

Gender, age, and income are the control variables. According to Model 1, gender

(being female) has a statistically significant and negative impact on the PHI and the MWI. Accordingly, being female reduces the PHI by 0.666 and the MWI by 1.606 units. Carter et al. (2014) report a significant association between gender and general health. The results for the statistically significant contribution of gender to the MWI are not conclusive. For instance, Beyer et al. (2014) reported that gender was significantly associated with depression, with females reporting fewer depressive symptoms than males. On the other hand, Strum et al. (2014) found an association between being female and suffering from worse mental health status. Their findings are consistent with those of Haesebaert et al. (2020), who discovered that being male predicted better mental well-being.

The different ways that females and males experience and use the park can indicate the impact of gender on park usage; hence, benefiting the green space; however, the results across the literature are inconclusive. For instance, studies show different health outcomes (e.g., higher blood sugar and cholesterol among women) based on gender (Paul, 2022), as well as different HOI results among men and women regarding their use of green spaces (Richardson E. a., 2010). On the other hand, Yigitcanlar et el. (2020) did not discover a significant difference between men and women in terms of mental health. In this study, Model 1 shows that gender has a positive impact (but not statistically significant) impact on the HOI, which might be due to personal or genetic factors. Moreover, the model indicates that being female has a negative insignificant impact on the SWI. But, Baur et al. (2013), did not discover gender to have a significant impact on SWI.

The existing literature does not suggest a conclusive result indicating if age has a statistically significant impact on perceived health or not. Yakinlar et al. (2022) and Sang et al. (2016) did not detect age-related impacts on general well-being. Model 1 does not

show that age has a positive insignificant impact on the PHI. The model shows that age has a statically significant and negative impact on the HOI, indicating that older age decreases the HOI by 0.010 units, which can be explained by the blood sugar, cholesterol, and blood pressure increase at older ages (Dzhambov, 2018). However, studies emphasize the significant role of green space in promoting health outcomes at different ages (Zhao, 2022; Dzhambov, 2018; de Keijzer, 2019). According to Model 1, age has a positive and statistically significant impact on the MWI, by 1 unit increase in age (a 10-year interval), the MWI increases by 0.068 units. This result mirrors other studies, indicating that age has a positive and statistically significant impact on MWI (Haesebaert, 2020; Beyer, 2014; Carter, 2014; Zhou, 2022; Lee H. a., 2019). Other studies report different results regarding the association between age and MWI. While Zhang et al. (2015) and Yakinlar et al. (2022) reported no statistically significant impact of age and the MWI, Strum et al. (2014) stated that age was associated with worse MWI. Moreover, there is a 0.020-unit decrease in the SWI by age increase, while Baur et al. (2013) age did not find a statistically significant association between age and the SWI.

The model shows that income has a positive and statistically significant impact on the PHI, the MWI, and the SWI. The positive and statistically significant impact of income on general health (PHI) accords with the finding of Carter et al. (2014). However, Yakinlar et al. (2022) detected no statistically significant association between income and PHI. The results of this model indicate that with a 1-unit income increase, the MWI will increase by 0.292 units, which is consistent with other studies (Beyer, 2014; Sarkar, 2017; Zhang Y. v., 2015). For instance, Beyer's study (2014) indicates the statistically significant impact of an individual's income on their mental well-being. People with lower incomes (less than

$20,000/year) reported more depression, anxiety, and stress symptoms compared with those who earned $75,000 or higher. However, Yakinlar et al. (2022) reported that income did not have a statistically significant impact on the MWI.

In Baur's research (2013), income did not show a statistically significant impact on the SWI. A study by Zhou et al. (2022) discovered that higher income has a positive and statistically significant impact on less social dysfunction. The first model shows that higher income improves SWI by 0.188 units, which is not compatible with Baur's findings. Since the SWI in this study is comprised of having social support and enjoying park attendance to be around others, social dysfunction will not be a matter of interest. Lastly, this model indicates that income has a negative impact on the HOI; however, the impact is not statistically significant. While higher income can translate to access to more health-promoting resources (e.g., healthier foods, health facilities, residing in health-promotive neighborhoods, having access to better health care, and a higher likelihood of having good health insurance), a report by the European Society of Cardiology (ESC) indicates that wealthier men are more likely to have higher blood pressure (Antipolis, 2020). Factors such as smoking, drinking/eating habits, genetic factors, and work and lifestyle contribute to health outcome indicators (e.g., blood sugar, hypertension, hypercholesterolemia, respiratory, and cardiovascular diseases).

In the second model (Table 7.2), the dependent variables (PHI, HOI, MWI, and SWI) are regressed on the following independent variables: Frequency, PII, SI, AC, PIIINT, SIINT, Age, Gender, and Income. The PIIINT and SIINT are the PII*Frequency and SI*Frequency interactions, where Frequency is the dummy variable (using Central daily or once or more times/week = 1 and using the park less, once, or more times per

month = 0). This model is constructed to discover the impact of frequent park usage on the dependent variables (PHI, HOI, MWI, and SWI) when people visit the park to conduct park-based activities (e.g., exercising, meditating, socializing, etc.). The values for park-related activities are as follows: Not using the park = 0, Somewhat using the park = 1, and using the park for a specific activity = 2. Model 2 shows that being female decreases the MWI by 1.6 units. Getting older improves the MWI by .065 units and decreases HOI and SWI by .01 and .02 units, respectively. The model suggests that higher income contributes to better PHI by .259 units. Moreover, the higher income contributes to better MWI and SWI by .302 and .180 units, respectively.

Table 7.2: Results of Multiple Linear Regression (Model 2)

	The Perceived Health Index (PHI)		**The Health Outcome Index (HOI)**		**The Mental Well-being Index (MWI)**		**The Social Well-being Index (SWI)**	
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
(Constant)	4.030	.014	1.408	.005	12.357	.000	7.317	.000
Frequency	**1.429**	**.092***	.280	.270	.905	.589	-.099	.902
PII	.010	.949	-.009	.848	-.052	.860	.115	.423
PIIINT	-.182	.432	-.049	.480	.111	.809	-.171	.440
SI	.063	.771	.078	.234	.533	.221	**.596**	**.005*****
SIINT	-.490	.159	-.023	.825	-.382	.580	.112	.734
AC	.229	.569	.029	.808	-.288	.718	-.585	.131
Gender	-.592	.110	.071	.520	**-1.563**	**.036****	-.173	.624
Age	.013	.257	**-.010**	**.005*****	**.065**	**.006*****	**-.019**	**.089***
Income	**.259**	**.000*****	.003	.895	**.302**	**.026****	**.180**	**.006*****
R^2	.250		.171		.217		.423	

***. Significant at the 1% level.
**. Significant at the 5% level.
*. Significant at the 10% level.

According to this model, Frequency has a statistically significant impact on perceived health at the 10% level. Despite my expectations, the interactions are not statistically significant. Accordingly, the impact of frequency does not vary by the PII and

SI values, and interactions did not modify the associations between frequent park usage and well-being measure. Table 7.3 depicts the fitted values for different PII and SI values. The model suggests that SI has a statistically significant and positive impact on SWI, where one unit change in the SI increases the SWI by .596 units in the second model. The results do not confirm my expectations that carrying out more frequent park-related activities (SI = 2 and PII = 2) will have a positive and statistically significant impact on the dependent variables (PHI, HOI, MWI, and SWI). The unexpected findings might be due to the questionnaire structure and respondents' options to provide feedback about park usage. Moreover, the results of park usage show that only 5.2% of respondents use the park exclusively for personal interest activities. 1.3% and 0% of respondents use the park merely for socializing or attending social events, respectively. On the other hand, 91% of people use the park for a combination of all reasons (personal interests and socializing). Consequently, the results affect the interaction terms in the second model where PIIINT = Frequency * PII and SIINT = SI * Frequency. More than 50% of both interaction terms were zero when I utilized the interaction function in the excel file.

Table 7.3: Impact of Frequency on Dependent Variables with Different PII and SI Values

SI and PII Values	Impact of Frequency on PHI	Impact of Frequency on HOI	Impact of Frequency on MWI	Impact of Frequency on SWI
SI = 0, PII = 0	1.429	.280	.905	-.099
SI = 0, PII = 1	1.247	.231	1.016	-.27
SI = 0, PII = 2	1.065	.182	1.127	-.441
SI = 1, PII = 0	.939	.257	.523	.013
SI =1, PII = 1	0.757	.208	.634	-.158
SI = 1, PII = 2	0.575	.159	.745	-.329
SI = 2, PII = 0	0.449	.234	.141	.125
SI = 2, PII = 1	0.267	.185	.252	-.046
SI =2, PII = 2	0.085	.136	.363	-.217

After implementing the interaction terms in this model, I conducted z-tests to examine whether variable estimates were different across Models 1 and 2. Nonetheless, the z-tests failed to conclude any statistically significant different the variable estimates across these models.

Log-Linear Regression Analysis

Table 7.4 presents the multiple linear regression results for Model 3, where the natural logs of dependent variables (PHI, HOI, MWI, and SWI) were regressed on independent variables to explore any possible non-linear association between dependent and independent variables. According to the model, PII has a positive and statistically significant impact on the LNHOI. A one-unit change in the PII decreases the LNHOI by about 5.2%. The model shows that the SI has a positive and statistically significant impact on the LNHOI. Accordingly, for every unit change in the SI, there is an 8% increase in the LNHOI. Moreover, SI has a positive and statistically significant impact on the LNSWI. A one-unit change in the SI increases the LNSWI by about 13%. Finally, the model shows that the AC has a negative and statistically significant impact on the LNSWI. Accordingly, for every unit change in the AC, there is a 15% decrease in the LNSWI.

As for the control variables, the results of Model 3 indicate that being female has negative and statistically significant impacts on the LNPHI and the LNMWI. Being female decreases the LNPHI by 11% and the LNMWI by 10%. Furthermore, age has negative and statistically significant impacts on the LNHOI and the LNSWI. A one-unit change in age decreases the LNHOI by 0.5% and the LNSWI by 0.4%. However, age has a positive and statistically significant impact on the LNMWI. With a one-unit change in age, the LNMWI increases by 0.4%. Lastly, the model indicates that income has positive and statistically

significant impacts on the LNPHI, LNMWI, and LNSWI. A one-unit increase in income level increases the LNPHI by 4%, the LNMWI by 1%, and the LNSWI by 3.6%.

Table 7.4: Results of Multiple Linear Regression (Model 3)

	The Perceived Health Index (LNPHI)		**The Health Outcome Index (LNHOI)**		**The Mental Well-being Index (LNMWI)**		**The Social Well-being Index (LNSWI)**	
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
(Constant)	1.588	.000	1.015	.005	2.529	.000	2.152	.000
Frequency	.036	.525	.082	.282	.044	.311	-.056	.403
PII	-.012	.534	**-.052**	**.044****	-.001	.937	.005	.836
SI	-.019	.523	**.081**	**.045****	.030	.188	**.132**	**.000*****
AC	.014	.832	-.127	.160	-.023	.643	-.149	**.056***
Gender	**-.110**	**.068***	.032	.688	**-.102**	**.031****	-.027	.699
Age	.002	.194	**-.005**	**.067***	**.004**	**.003*****	**-.004**	**.057***
Income	**.042**	**.000*****	-.019	.200	**.019**	**.023****	**.036**	**.007*****
R^2	0.219		0.178		0.221		0.352	

***. Significant at the 1% level.
**. Significant at the 5% level.
*. Significant at the 10% level.

In model 4, the natural logs of dependent variables (PHI, HOI, MWI, and SWI) are regressed on the following independent variables: Frequency, PII, SI, AC, PIIINT, SIINT, Age, Gender, and Income (Table 7.5). The results do not validate my hypothesis and the interaction terms are not statistically significant. According to the model, SI has a positive and statistically significant impact on the LNSWI. A one-unit change in the SI increases the LNHOI by about 9%. SI has a positive and statistically significant impact on the LNSWI. A one-unit change in the SI increases the LNSWI by about 12%. Being female has negative and statistically significant impacts on the LNPHI and the LNMWI. Being female decreases the LNPHI by 10% and the LNMWI by 10%. Furthermore, age has negative and statistically significant impacts on the LNHOI and the LNSWI. A one-unit change in age decreases the LNHOI by 0.5% and the LNSWI by 0.4%. However, age has

a positive and statistically significant impact on the LNMWI. With a one-unit change in age, the LNMWI increases by 0.4%. Lastly, the model indicates that income has positive and statistically significant impacts on the LNPHI, LNMWI, and the LNSWI. A one-unit increase in income level increases the LNPHI by 4%, the LNMWI by 2%, and the LNSWI by 3.3%.

Table 7.5: Results of Multiple Linear Regression (Model 4)

	The Perceived Health Index (LNPHI)		**The Health Outcome Index (LNHOI)**		**The Mental Well-being Index (LNMWI)**		**The Social Well-being Index (LNSWI)**	
	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
(Constant)	1.481	.000	.986	.010	2.527	.000	2.101	.000
Frequency	.217	.117	.129	.505	.048	.657	.031	.851
PII	-.001	.970	-.048	.147	-.005	.780	.023	.433
PIIINT	-.028	.463	-.009	.863	.010	.726	-.045	.316
SI	.006	.863	**.087**	**.088***	.038	.177	**.122**	**.005*****
SIINT	-.068	.232	-.014	.860	-.023	.610	.030	.652
AC	.030	.651	-.123	.187	-.022	.663	**-.143**	**.072***
Gender	**-.100**	**.099***	.036	.667	**-.099**	**.039****	-.029	.688
Age	.002	.315	**-.005**	**.073***	**.004**	**.006*****	**-.004**	**.079***
Income	**.042**	**.000*****	-.019	.209	**.020**	**.022****	**.033**	**.012****
R^2	.245		.179		.225		.343	

***. Significant at the 1% level.
**. Significant at the 5% level.
*. Significant at the 10% level.

After performing the interaction terms in the fourth model, I conducted a z-test to test if the variable estimates differed across Models 3 and 4. The z-test failed to conclude any statistically significant differences in the variable estimates between two models.

Conclusion

Four regression models were constructed to test my hypothesis that frequent park usage contributes to physical, mental, and social well-being of Old Louisville residents. Some results were surprising in terms of either partially validating my hypothesis or not supporting it at all. For instance, Model 1 (Table 7.1) did not show that frequent park visits promote various aspects of well-being (the perceived health, the health outcome, mental and social well-being). The model indicated that the demographic characteristics (e.g., gender, age, and income) of the respondents are the most influential predictors of one's well-being status. Although I did not expect these outcomes, the literature suggests that a region's climate (e.g., being (sub)tropical) and being surrounded by greenness might make it difficult to assess the impact of green space usage on well-being (Saw, 2015). Moreover, the majority of respondents (86%) reported being healthy in general, which can explain the park's insignificant impact on well-being in the model.

The second model included two interaction terms to explore the possible associations between park-based personal and social activities and well-being. However, the interactions were not statistically significant and the impact of frequency on PHI, HOI, MWI, and SWI did not vary by PII and SI in models 2 and 4. To compare four models and identify the best model for well-being, I calculated the RMSE[1] and AIC[2] for each of the subdomains of well-being (perceived health, health outcome, mental, and social well-being) in every model (Tables 7.6 to 7.9). Table 7.6 indicates that model 4 is the best regression model for the PHI domain with the minimum RMSE and AIC. This model

[1] - Root Mean Square Error

[2]- Akaike information criterion

includes nine variables (including the control variables) and explains 15% of the score variance. None of the expected variables are statistically significant in this model. In fact, the two significant predictors of the LNPHI in the best-fitting model were gender (B = -.10, *p* = .099) and income (B = .042, *p* = .000) (Table 7.5).

Table 7.6: Model Selection Overview for Perceived Health Index (PHI)

Model	Perceived Health Index (PHI)	K[a]	RMSE	R^2	Adj. R^2	AIC	Sig.
Model 1 (PHI)	Frequency + PII + SI + AC + Gender + Age + Income	7	1.378	.215	.137	307.400	**.014****
Model 2 (PHI)	Frequency + PII + PIIINT + SI + SIINT+ AC + Gender + Age + Income	9	1.346	.250	.151	300.865	**.015****
Model 3 (LNPHI)	Frequency + PII + SI + AC + Gender + Age + Income	7	.224	.219	.141	24.904	**.013****
Model 4 (LNPHI)	Frequency + PII + PIIINT + SI + SIINT+ AC + Gender + Age + Income	9	.22	.245	.146	18.527	**.017****

a: Number of parameters in the model

**. Significant at the 5% level.

According to Table 7.7, Model 3 can be selected as the best regression model, which includes seven variables. Even though Model 3 does not have the lowest AIC compared to Model 4, the candidate model is significant at the 10% level. This level of significance is not the most desirable certainty level in research. Moreover, the model explains only 9% of the score variance (the highest among the four models). There are only three variables in this model that are statistically significant: PII (B = -.052, *p* = .044), SI (B = .081, *p* = .045), and age (B = -.005, *p* = .067) (Table 7.4).

Table 7.7: Model Selection Overview for Health Outcome Index (HOI)

Model	Perceived Health Index (HOI)	K[a]	RMSE	R^2	Adj. R^2	AIC	Sig.
Model 1 (HOI)	Frequency + PII + SI + AC + Gender + Age + Income	7	.407	.164	.080	101.538	**.073***
Model 2 (HOI)	Frequency + PII + PIIINT + SI + SIINT+ AC + Gender + Age + Income	9	.406	.171	.062	99.291	.144
Model 3 (LNHOI)	Frequency + PII + SI + AC + Gender + Age + Income	7	.28	.178	.090	46.139	**.067***
Model 4 (LNHOI)	Frequency + PII + PIIINT + SI + SIINT+ AC + Gender + Age + Income	9	.28	.179	.062	39.142	.158

a: Number of parameters in the model
*. Significant at the 10% level.

Table 7.8 shows that Model 4 can be selected as the best regression model for the mental well-being index (MWI) and explains 12% of the score variance. The model had the lowest RMSE and AIC. It includes nine predictors, three of which are statistically significant: gender (B = -.099, *p* = .039), age (B = .004, p = .006), and income (B = .02, *p* = .022) (Table 7.5). None of the expected predictors were statistically significant in this model (e.g., frequency, PI, PIIINT, SI, SIINT, and AC).

Table 7.8: Model Selection Overview for Mental Well-being Index (MWI)

Model	Perceived Health Index (MWI)	K[a]	RMSE	R^2	Adj. R^2	AIC	Sig.
Model 1 (MWI)	Frequency + PII + SI + AC + Gender + Age + Income	7	2.691	.213	.135	402.116	**.015****
Model 2 (MWI)	Frequency + PII + PIIINT + SI + SIINT+ AC + Gender + Age + Income	9	2.685	.217	.114	390.667	**.042****
Model 3 (LNMWI)	Frequency + PII + SI + AC + Gender + Age + Income	7	.174	.221	.143	-25.820	**.012****
Model 4 (LNMWI)	Frequency + PII + PIIINT + SI + SIINT+ AC + Gender + Age + Income	9	.173	.225	.122	-45.621	**.033****

a: Number of parameters in the model

**. Significant at the 5% level.

Based on Table 7.9, Model 4 is the best regression model for SWI with the lowest RMSE and ACI. The model explains 34% of the score variance and is statistically significant at the 1% level. Four out of nine predictors were statistically significant in the third model: SI (B = .122, p = .005), AC (B = -.143, p = .072), Age (B = -.004, p = .079), and income (B = .033, p = .012) (Table 7.5).

Table 7.9: Model Selection Overview for Social Well-being Index (SWI)

Model	Perceived Health Index (MWI)	K[a]	RMSE	R^2	Adj. R^2	AIC	Sig.
Model 1 (SWI)	Frequency + PII + SI + AC + Gender + Age + Income	7	1.298	.417	.359	302.846	**.000*****
Model 2 (SWI)	Frequency + PII + PIIINT + SI + SIINT+ AC + Gender + Age + Income	9	1.292	.423	.346	295.794	**.000*****
Model 3 (LNSWI)	Frequency + PII + SI + AC + Gender + Age + Income	7	.265	.411	.352	60.757	**.000*****
Model 4 (LNSWI)	Frequency + PII + PIIINT + SI + SIINT+ AC + Gender + Age + Income	9	.263	.420	.343	58.355	**.000*****

a: Number of parameters in the model

***. Significant at the 1% level.

CHAPTER VIII CONCLUSION

High blood pressure, obesity, diabetes, high cholesterol, mental health crisis, and social isolation have significant economic consequences for the U.S. government. For instance, the U.S. healthcare system's expenditure on obesity is $173 billion annually (CDC C. f., 2022). In addition, diabetes and its related complications are other expensive chronic conditions that the U.S. healthcare system spends more than $327 billion on them, per year (CDC, 2022). Moreover, high blood pressure costs the nation about $198 billion each year (CDC, 2022), and the annual cost of treating cardiovascular disease (CVD), which is more prevalent among people with high cholesterol, is $17 to $259 million (Ferrara, 2021). In 2020, almost $280 billion was spent on mental health services (CEA, 2022). Furthermore, there are more consequential costs and complications regarding each of the aforementioned diseases. Most of these diseases can increase the risk of other conditions. For instance, overweight and obese increase the risk of coronary heart disease, type II diabetes, and cancers (CDC, 2019). One way to alleviate some of the burden on the healthcare system is through the provision of health-promoting infrastructures (e.g., green urban spaces) and informing the public about the benefits of using such spaces to reduce some of these risk factors.

A growing body of empirical research tries to manifest the importance and benefits of urban parks (Kim G. a., 2019; Lopez, 2021; Younan, 2016). Accordingly, this dissertation concentrated on Central Park in Louisville, KY, to discover its contribution to the well-being of Old Louisville residents. The study is based on three main questions. The first question inspected how residents of the old Louisville neighborhood use Central Park. The purpose of this question was to establish an understanding of the park's usage pattern among residents and discover their perception of the quality of the park (e.g., accessibility, inclusiveness, and safety). The second question explored whether frequent park usage improved residents' physical and mental well-being. The third question examined if Central Park contributed to individuals' social well-being. Social well-being is a less-discussed issue in public health, which is now receiving attention from urban scholars and health professionals. The U.S. Surgeon General's Advisory[1] discusses the importance of social connection and its contribution to health and introduces six pillars to advance social connection. The first pillar -Strengthening Social Infrastructure in Local Communities- focuses on the physical form and built environment of a community (e.g., parks and libraries) and how they can support social connection (Murthy, 2023).

As the literature suggests, accessible, inclusive, comfortable (Mehta, 2014), and safe public spaces provide suitable environments for personal and social activities and increase the likelihood of exercising, which in turn, can contribute to users' well-being (Nemeth, 2011; Mehta, 2014; Richardson E. A., 2013). The results of the first question indicated that Central Park was accessible to the majority of park users (97.5%) and that

[1] - "A Surgeon General's Advisory is a public statement that calls the American people's attention to an urgent public health issue and provides recommendations for how it should be addressed" (Murthy, 2023).

the short subjective distance, as well as the lack of any physical barrier for 94% of the residents, made the park a prominent instance of accessible public space in the dense fabric of the Old Louisville neighborhood. The proximity, accessibility, inclusiveness, residents' satisfaction with parks' maintenance and recreation facilities, safety, and comfortable amenities (e.g., benches, walkways, and comfortable environment during hot seasons) contribute to residents' frequent and regular park usage around the clock. Yet, does park usage contribute to the users' physical, mental, and social well-being? To explore the answers to the second and third questions of the research, I conducted the following steps.

Analysis of the survey data was undertaken using the Statistical Package for Social Sciences (SPSS) Version 26. Frequencies and percentages were calculated to discover the park usage patterns, the perception of the quality of the park, and socio-demographic data. I utilized SPSS to assess the pairwise correlations between each measure of the dependent variables. To provide meaningful interpretations, I performed Principal Component Analyses (PCA) in SPSS to reduce the number of physical, mental, and social well-being variables. I utilized SPSS to regress the dependent variables (PHI, HOI, MWI, and SWI) on independent (frequency, PII, SI, AC) and control variables (gender, age, and income). Four multiple linear regression models with the best predictive power for well-being were the candidate sets of models. The multicollinearity was a concern only in models that I had considered variable interaction (e.g., PIIINT = PII * frequency and SIINT = SI* frequency). Otherwise, the Variance Inflation Factor (VIF) values were 1.88 or lower.

Despite my expectations, frequent park usage did not have a statistically significant impact on four well-being measures proposed as dependent variables (PHI, HOI, MWI, and SWI). First, I expected the frequency to be significantly associated with perceived

health. Nonetheless, except for Model 2, which considered two interactions and frequent park usage became statically significant at the 10% level, this independent variable had a positive insignificant impact on PHI across Models 1, 3, and 4. Second, surprisingly, frequent park visits did not show a statistically significant positive impact on the health outcome index including blood pressure, diabetes, and cholesterol. The impacts of frequent park usage on one's health outcome are depicted in all models; however, the results are insignificant. But studies show that green space exposure promotes health outcomes by reducing the risks of cardiovascular diseases (Yeager R. R., 2018; Riggs, 2021), promoting chances of physical activity (Kim G. a., 2019), and decreasing obesity risk (Young, 2014). A deeper literature exploration indicates that duration, frequency, and intensity of exposure to nature are important in lowering blood pressure, reducing depression, and increasing social cohesion. According to Shanahan et al. (2016), for park usage to lower blood pressure and depression, the visits should be 30 minutes or more per week. Moreover, frequent park visits increase social cohesion, and longer and more frequent park visits lead to higher levels of physical activity. However, there was no statistically significant correlation between the duration of park visits and well-being measures when I conducted Spearman's Correlation analysis before conducting the regression analysis.

Third, the findings verify my hypotheses partially regarding the association between frequent park usage and mental well-being. The results show that recurring park visits promote users' mental well-being; however, the impact is not statistically significant. Various factors can contribute to one's mental health (e.g., genetics and economic status) and willingness to visit the park (e.g., lack of motivation). Even though the statistically insignificant association between frequent park use and different measures of well-being

might appear surprising, some studies concluded similarly. For instance, Pun et al. (2018) discovered that greenness (measured by NVDI[1]) is not significantly associated with anxiety and depression. But their results indicate that greenness is associated with more anxiety and stress reduction among physically active Whites with a higher socioeconomic status. In another study in Singapore, Saw et al. (2015) did not observe a statistically significant association between using or access to green space and well-being metrics. A Swedish study also did not detect an association between access to green space and mental distress (Annerstedt, 2012). Miles et al. (2012) did not find a significant relationship between green space coverage and depressive symptoms in their study in Miami, FL.

Fourth, frequent park visits were not significantly associated with the social well-being index. One justification might be the type of questions that constructed SWI. For instance, having social support can be a control variable for pre-existing social well-being. Changing the social well-being question might have changed the results. For instance, I could have asked if park usage promotes sense of community and belonging in respondents. I could have inquired how often people run to their acquaintances or stop to chat with other park users. Another unexpected result was the absence of a positive statistically significant association between park-based personal activities (e.g., exercising or meditating) and health outcomes (e.g., blood pressure and diabetes) in three models. The negative impact of PII on HOI (although insignificant) can be due to the nature of the responses provided by participants. For instance, the park usage pattern for exercising only pertains to 1.3% of respondents. No one uses the park just for meditation. Yet, 91% of the sample population uses Central Park for multiple reasons. All models support my

[1] - Normalized Difference Vegetation Index

hypothesis regarding the statistically significant association between conducting park-based social activities and social well-being. Moreover, the two models indicate a statistically significant association between SI and LNHOI.

Lastly, the association between park accessibility and the four well-being measures was not statistically significant across models. It has a positive impact on the PHI in all models and a negative association with MWI and SWI in four models. The accessibility component (AC) was positively associated with HOI in Models 1 and 2 and negatively associated with their corresponding values in Models 2 and 4 (LNHOI). Regardless of these results, Larson et al. (2016) discovered that proximity and accessibility may not necessarily translate into more park usage and its consequent well-being improvement.

Regardless of the pre-existing conditions of my survey participants that contribute to well-being (e.g., age, genetics, eating and drinking habits), I expected frequent park usage to promote well-being. Nonetheless, the main contributors to well-being were gender, age, and income in all models. The literature does not provide a conclusive and consistent result regarding the statistically significant associations between socioeconomic variables and well-being when assessing the association between park usage and wellness. For instance, Wang et al. (2020) reported a significant relationship between gender, age, and income and their respondents' mental well-being. But Yigitcanlar et al. (2020) found no relationship between these variables and perceived health and mental well-being. The findings that associate well-being with green space usage and exposure conclude inconsistently regarding the significance of the impact. However, to my knowledge, no research denies the importance of green public spaces in advancing the environmental quality of urban neighborhoods.

Limitations of the Research

Several limitations of the present study should be noted. First, its cross-sectional nature does not allow the establishment of a conclusion about the causal pathway between independent variables and the outcome of interest. Even if the relationships depicted in the models present strong associations between park usage and perceived health (PHI), mental well-being (MWI), and social well-being (SWI), experimental and longitudinal research is required to determine the causal relationship. Second, the low response rate (4.04%) is another limitation of this study. Moreover, there is no thorough estimation of the participation rate since the drop-off method did not allow for triangulation and follow-up with those who did not participate. Furthermore, the discrepancies between the PVA data and my on-site observations made it difficult to determine the real number of occupied residences in the study area.

Third, the generalizability of my findings is limited by the data as well as the sample not being representative of the population. For instance, some of the responses that were eliminated due to missing data were provided by the Hispanic respondents. The sample is not representative of the younger, lower-income, less-educated, African Americans, Hispanics, and unmarried population. The differences in the sample relative to the study area (census tracts 51, 52, and 66) and Jefferson County bar the research from providing a thorough and generalized conclusion. For instance, 62% of the sample earns more than the median household income in Louisville in 2021, while the study area suffers from an unequal income inequality compared to the average of the dashboard cities (Dashboard, n.d.). In this regard, people with higher income (e.g., the sample population) are more likely to afford health insurance (e.g., provided by their employers), hence, receiving better

healthcare. Even though higher-paying careers can be stressful and deplete people's energy, it can also give people peace of mind and less anxiety about financial needs. These preexisting conditions make the inference less practicable. Moreover, the highly educated nature of the sample can affect respondents' knowledge about various aspects of health and well-being and their attempt to promote them. They might have more resources regarding the impact of green space and park-related activities on well-being. Fourth, self-selection bias could not be avoided since I had no control over selecting the respondents.

Suggestions for Future Research

This research, to my knowledge and based on an in-depth search of literature- is the first empirical study conducted in Louisville to assess the cumulative impact of park usage on well-being. Future studies can implement this research as a pilot study in seven different ways. First, my models did not provide statistically significant associations between park usage and well-being measures, while studies prove that residence exposure and proximity to greenness are associated with better mental well-being (Sturm, 2014) and lower risks of cardiovascular disease by reducing air pollution (Riggs, 2021; Yeager R. R., 2018). Is my respondents' pre-existing good health accountable for the insignificant association between park usage and well-being? Is the dense green coverage of the Old Louisville neighborhood already an implicit contributor to residents' well-being? Why are age, gender, and income the main contributors to respondents' well-being? The first suggestion focuses on investigating the questions related to the unexpected results of the current study and discovering the discrepancies. For instance, researchers can incorporate the length of residence into their work, survey new residents of a compact urban neighborhood (e.g., Old Louisville), and conduct a comparative analysis to examine the

impact of green space exposure on new residents. Moreover, researchers can use the Normalized Difference Vegetation Index (NDVI), population density, and well-being measures to discover the possible implicit contribution of green space abundance to well-being. Future studies can conduct similar research in another compact but less green neighborhood in Louisville and compare the findings.

Second, my research was limited to park users hence not providing insight into non-users and well-being. Future studies can include both the users and non-users and compare the results while asking for the reasons that prevent people from using Central Park. The third suggestion pertains to the sampling strategy. By conducting a 100%-household sampling and survey distribution in three census tracts, this study attempted to (1) provide a universal conclusion regarding the association between frequent park usage and well-being aspects and (2) allow each household to have an equal chance of participating in this study. On the contrary, the self-selection bias -caused by respondents' preference to accept or avoid participation, led to the undesirable non-representative sample. Different factors can bar people from visiting a nearby park. Issues such as depression, fear of being in public, lacking enough time for recreation and leisure activities could have contributed to self-selection bias. Future studies can improve the sampling by executing a probability sampling method (e.g., simple random sampling, systematic sampling, stratified, or cluster sampling). Moreover, studies can utilize random sampling for each household to avoid or reduce self-selection bias.

The fourth suggestion refers to the data collection method. This study utilized a questionnaire for gathering data about participants' well-being and park usage. With the low response rate affecting the results, future studies can adopt different data collection

methods: such as in-depth or on-site surveys/interviews. One way to increase the response rate is to offer incentives to the participants -which was not affordable in this research. Hence, other studies might find financial resources to encourage people to participate. Fifth, the comprehensive nature of this research required a lengthy survey which might have made it cumbersome for respondents to participate. After analyzing the data, I discovered the redundancy of some questions (e.g., the general health questions in the physical well-being sections) and the small numbers in the social well-being section. Social well-being has been an overlooked wellness measure -which can be studied more deeply in future studies. Future research can also ask questions regarding individuals' lifestyles (e.g., drinking, eating, and socializing habits) to explore the preexisting contributors to one's well-being. Another survey structure change can ask respondents how they perceive their health change with or without using the Park.

Sixth, future studies can adopt one measure of this research (e.g., PHI, SI, MWI, or SWI) and carry on a shorter survey which might increase the response rate, therefore generalizability power of the findings. Finally, according to the literature, the perception of the quality of public spaces affects the extent that people use them. Nonetheless, this study did not substantiate that. Moreover, having a green backyard or living in a neighborhood with a dense green canopy (e.g., old Louisville) might render some residents needless from using the park. Therefore, future studies could consider how and if residents' perceptions and park quality encourage further park usage.

Policy and Planning Implications

It has been more than a century since Fredric Law Olmsted raised the awareness of improving the built environment to promote public health in all aspects (physical, mental,

and social) in American cities (Peterson, 1979; Eisenman, 2013). Now, in the 21st century, we need to incorporate more accessible quality green spaces in our dense cities to combat the undesirable consequences of a sedentary lifestyle. Promoting the quality of urban life and reducing its undesirable impacts on well-being requires an orchestrated attempt from various fields (e.g., urban planning and management and the health profession). Even though the causal relationship between proximity and exposure to greenness and wellness has not been discovered, the positive impacts of such spaces make urban parks an effective tool that urban planners and policymakers can implement to alleviate the negativities to some extent.

In line with the healthy city trend, Louisville's Plan 2040 envisions the city as a healthy city in 17 years (Government, 2019). Based on this plan, well-designed, well-distributed, and accessible parks are the community facilities that can contribute to the establishment of the Plan 2040 vision by (1) contributing to the authenticity principle when their unique character and significant features are recognized, (2) improving the quality of life for all citizens and promoting sustainable lifestyles and development as existing green infrastructures, and (3) contributing to citizens' physical, mental, and social well-being and realizing the health principle in Plan 2040 (Government, 2019). Despite the growing attention to healthy cities, Jefferson County suffers from undesirable health outcomes compared to the national average according to the CDC reports. For instance, the age-adjusted high blood pressure prevalence[1] among adults is %37.4 in Jefferson County, which exceeded the national average (%29.6)[2]. The age-adjusted high cholesterol

[1] - Adults aged >= 18 years

[2] - Data is from 2019.

prevalence at the national level is %28.7 and %35.3 at the county level. Table 8.1 depicts a summary of some health outcomes in Jefferson County and their counterparts at the national level.

Table 8.1: Age-adjusted prevalence % (95% CI) Health Outcomes and Health Status (United States and Jefferson County, KY.)

Measure Data Type	**United States Census 2020 Population: 331,449,281**	**Jefferson, KY. Census 2020 Population Estimate: 767,452**
Coronary heart disease among adults aged >=18 years - 2020	5.5 (5.3 – 5.6)	6.1 (5.6 – 6.7)
Diagnosed diabetes among adults aged >=18 years - 2020	9.7 (9.5 – 9.9)	10.6 (9.9 – 11.3)
Obesity among adults aged >=18 years - 2020	32.0 (31.6 – 32.4)	36.4 (35.0 – 37.6)
Depression among adults aged >=18 years - 2020	18.5 (18.2 – 18.8)	24.2 (23.0 – 25.4)
No leisure-time physical activity among adults aged >=18 years- 2020	22.9 (22.6 – 23.3)	26.5 (24.0 – 29.0)
Health Status		
Mental health not good for >=14 days among adults aged >=18 years - 2020	13.9 (13.7 – 14.2)	17.2 (16.0 – 18.4)
Physical health not good for >=14 days among adults aged >=18 years - 2020	9.4 (9.2 – 9.6)	11.7 (10.6 – 12.8)
Fair or poor self-rated health status among adults aged >= 18 years - 2020	13.7 (13.4 – 13.9)	16.7 (14.8 – 18.7)

Source: (PLACES, 2023)

The total cost of care per capita for Medicare beneficiaries diagnosed with heart disease was $20,202 in 2020 (Prevention, n.d.). Kentucky's annual costs attributable to diabetes were $6,077 million in 2013 (CDC, 2013). These are two instances of the economic burden of diseases at the state level. The costs are not limited to the monetary and direct value of treatments. The indirect costs are also considered in some cases. For

instance, work absenteeism and presenteeism, household productivity losses, inability to work, and premature mortality are included while calculating the total economic costs of diabetes (CDC, 2013).

The Old Louisville neighborhood is one of the densest areas in Louisville with compact tree canopies. The projected density for 2040 still represents the Downtown area, among the densest areas of Louisville. Even though the study area is highly walkable and park accessibility is dramatically higher than the comparing cities, only %37.9 of Louisvillians lived within a 10-minute walk of green space in 2018 (Dashboard, n.d.). As for the study area, the physical inactivity rate, physical distress, mental distress, high blood pressure, and obesity rate are above the average when compared to other cities in 2019 (Dashboard, n.d.). This research provided a contextual instance by exploring the contribution of Central Park to the well-being of the Old Louisville community. Even though the results were not statistically significant, they indicated a positive association between four well-being measures and well-being. By focusing on the existing green infrastructure in such a dense and populated area, this dissertation has added to the background information about the strengths and weaknesses of the current conditions of Central Park. It will also assist urban planners and policymakers in establishing a baseline for decision-making by referring to a local empirical study.

The main policy implication of this research pertains to land use which will facilitate Louisville's sustainable, equitable, and healthy development. Accordingly, the local government must preserve and upgrade the existing green infrastructures, which encourage physical activity, promote connectivity, and reduce the negative impacts of the urban heat island (UHI). As mentioned at the beginning of this section, some Louisville

residents are subject to environmental injustice. Lack of access to green spaces is an example of such inequity. Hence, land use and development plans for the future of Jefferson County must incorporate accessible and well-designed green public spaces in all developments, particularly in compact/dense urban neighborhoods. Future developments should encourage walkability by designing safe, quality, and well-connected green spaces. Furthermore, three major departments at Louisville-Jefferson County Metro Government (Health & Wellness, Parks, and Planning & Design departments) should collaborate in incorporating well-being measures for assessing neighborhood improvement/development programs. As for the planning/designing implications, this study suggests that Central Park management needs to improve the park's recreation facilities and maintenance (only 38.5% of respondents were satisfied with the park's facilities, and 31% were satisfied with the park's management). In addition, enhancing the physical access for disabled people is required to elevate the park's inclusiveness (only 44% of the participants considered Central Park to be inclusive for disabled users).

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APPENDIX: SURVEY QUESTIONS

Section I: Park Usage

Questions in Section I inquire about your park usage and interactions with the Central Park before the COVID-19 pandemic (i.e., before December 2019) and nowadays (i.e., in the past couple of months).

1.1 Which of the followings refers to your working/studying condition?

Before December 2019	**Nowadays**
□ I had to go to my workplace/school.	□ I go to my workplace/school.
□ I worked/studied remotely.	□ I work/study remotely.
□ It was hybrid.	□ It is hybrid.
□ I did not work/study.	□ I do not work/study.

1.2. How frequently have you used the park?

Before December 2019	**Nowadays**
□ I did not live in the neighborhood	
□ Daily	□ Daily
□ Once or more times/week	□ Once or more times/week
□ Once or more times/month	□ Once or more times/month
□ Less than once/month	□ Less than once/month

1.3. What has been the average length of the time you have spent in the park?

Before December 2019	**Nowadays**
□ I did not live in the neighborhood	□ Less than 15 minutes
□ Less than 15 minutes	□ 15 to 30 minutes
□ 15 to 30 minutes	□ Up to one hour
□ Up to one hour	□ More than one hour
□ More than one hour	

1.4. When have been your regular visits to the park?

Before December 2019	**Nowadays**
□ I did not live in the neighborhood	
□ Weekdays	□ Weekdays
□ Weekends	□ Weekends
□ Holidays	□ Holidays
□ Special occasions	□ Special occasions
□ During my spare time	□ During my spare time

1.5. What kinds of transportation modes have you used to get to the park?

Before December 2019	**Nowadays**
□ I did not live in the neighborhood	
□ I used my personal vehicle	□ I use my personal vehicle
□ I biked or used my scooter/wheelchair	□ I bike or use my scooter/wheelchair
	□ I walk to the park
□ I walked to the park	□ I take the bus
□ I took the bus	

1.6. Which of the followings best indicates your preferred time to go to the park?

Before December 2019	**Nowadays**
□ I did not live in the neighborhood	
□ Morning	□ Morning
□ Noon	□ Noon
□ Afternoon	□ Afternoon
□ Evening	□ Evening
□ Night	□ Night

1.7. Approximately, how long has it been taking you to get to the park?

Before December 2019	**Nowadays**
□ I did not live in the neighborhood	
□ Less than five minutes	□ Less than five minutes
□ Between 6 to 15 minutes	□ Between 6 to 15 minutes
□ Between 16 to 30 minutes	□ Between 16 to 30 minutes
□ More than 30 minutes	□ More than 30 minutes

1.8. Were any of the followings your main reasons to go to the park?

	Before December 2019			**Nowadays**		
a) I did not live in the neighborhood	□ Yes		□ No			
b) To exercise	□ Yes	□ Somewhat	□ No	□ Yes	□ Somewhat	□ No
c) To walk my dog	□ Yes	□ Somewhat	□ No	□ Yes	□ Somewhat	□ No
d) To mediate	□ Yes	□ Somewhat	□ No	□ Yes	□ Somewhat	□ No
e) To socialize	□ Yes	□ Somewhat	□ No	□ Yes	□ Somewhat	□ No
To enjoy the natural environment	□ Yes	□ Somewhat	□ No	□ Yes	□ Somewhat	□ No
g) To improve my mood	□ Yes	□ Somewhat	□ No	□ Yes	□ Somewhat	□ No
h) To attend social events	□ Yes	□ Somewhat	□ No	□ Yes	□ Somewhat	□ No

Section II: Perception of the Quality of the Park

Questions in Section II inquire about your personal opinions about the accessibility, inclusiveness, functions, amenity and comfort, safety and security, and quality of the Central Park before the COVID-19 pandemic (i.e., before December 2019) and nowadays (i.e., in the past couple of months).

2.1. How has been the accessibility to the Central Park from where you live?

Before December 2019

□ I did not live in the neighborhood
□ Very poor
□ Poor
□ Fair
□ Good
□ Excellent

Nowadays

□ Very poor
□ Poor
□ Fair
□ Good
□ Excellent

2.2. Have there been any physical barriers that limit your access or use of the park? (e.g., lack of ramps if you use a wheelchair, broken pavement, or any ditch that would make it difficult to access the park in rainy days)?

Before December 2019

□ I did not live in the neighborhood
□ Yes
□ No

Nowadays

□ Yes
□ No

2.3 In your opinion, has Central Park met the needs of all genders?

Before December 2019

□ I did not live in the neighborhood
□ Yes
□ Somewhat
□ No

Nowadays

□ Yes
□ Somewhat
□ No

2.4. In your opinion, has Central Park met the needs of all age groups?

Before December 2019

□ I did not live in the neighborhood
□ Yes
□ Somewhat
□ No

Nowadays

□ Yes
□ Somewhat
□ No

2.5. In your opinion, has Central Park met the needs of disables people?

Before December 2019

□ I did not live in the neighborhood
□ Yes
□ Somewhat
□ No

Nowadays

□ Yes
□ Somewhat
□ No

2.6. Have you been satisfied with the park's physical conditions (e.g., walkways, greenery, restrooms, lights, ...), maintenance, and management?

Before December 2019

□ I did not live in the neighborhood
□ Yes
□ Somewhat
□ No

Nowadays

□ Yes
□ Somewhat
□ No

2.7. Have you been satisfied with the park's recreation facilities?

Before December 2019

□ I did not live in the neighborhood
□ Yes
□ Somewhat
□ No

Nowadays

□ Yes
□ Somewhat
□ No

2.8. How has your feelings about the park's safety from the crime after dark changed?

Before December 2019

□ I did not live in the neighborhood
□ Decreased a lot
□ Decreased moderately
□ Decreased a little
□ No change
□ Increased a little
□ Increased somewhat
□ Increased a lot

Nowadays

□ Decreased a lot
□ Decreased moderately
□ Decreased a little
□ No change
□ Increased a little
□ Increased somewhat
□ Increased a lot

2.9. What kind of park amenities has made this place comfortable for you? (Please select all that apply).

Before December 2019

□ I did not live in the neighborhood
□ Seats/Benches
□ Amphitheater
□ Picnic Tables
□ Playground
□ Restrooms
□ Spray Ground
□ Tennis Court
□ Volleyball Field
□ Walkways
□ Comfortable environment during hot seasons (e.g., shade and shelter)
□ Others (Please specify) _____

Nowadays

□ Seats/Benches
□ Amphitheater
□ Picnic Tables
□ Playground
□ Restrooms
□ Spray Ground
□ Tennis Court
□ Volleyball Field
□ Walkways
□ Comfortable environment during hot seasons (e.g., shade and shelter)
□ Others (Please specify) _____

2.10. How has your feelings about the park's safety from the crime during daytime changed?

Before December 2019

□ I did not live in the neighborhood
□ Decreased a lot
□ Decreased moderately
□ Decreased a little
□ No change
□ Increased a little
□ Increased somewhat
□ Increased a lot

Nowadays

□ Decreased a lot
□ Decreased moderately
□ Decreased a little
□ No change
□ Increased a little
□ Increased somewhat
□ Increased a lot

Section III: Socio-Economic Information

3.1. How many people live in your household (including yourself)?

_____

3.2. What is your gender?

□ Male □ Female □ Other

3.3. What year were you born? _____

3.4 What is your marital status?

□ Married
□ Single (Never married)
□ Widowed
□ Divorced
□ Separated

3.5. What is your highest degree of education?

□ Less than high school graduate
□ High school graduate
□ Some college or associate degree
□ Bachelor's degree or higher

3.6. Are you of Hispanic, Latino, or Spanish origin?

□ Yes □ No

3.7. What is your race?

□ White
□ Black, African American
□ American Indian or Alaska Native
□ Asian Indian
□ Chinese
□ Filipino
□ Japanese
□ Korean
□ Vietnamese
□ Native Hawaiian
□ Guamanian or Chamorro
□ Samoan
□ Other Pacific Islander
□ Some Other Race

3.8. What is your household income?

□ Less than $10,000
□ $10,000 to $14,999
□ $15,000 to $24,999
□ $25,000 to $34,999
□ $35,000 to $49,999
□ $50,000 to $74,999
□ $75,000 to $99,999
□ $100,000 to $149,999
□ $150,000 to $199,999
□ $200,000 or more

3.9. What is your current employment status?

□ Employed Full-Time
□ Employed Part-Time
□ Seeking opportunities
□ Retired
□ Not ready to enter the job market

3.10. Which of the followings represents your housing type?

□ Single-family house
□ Multi-family house
□ Apartment
□ Senior Housing

3.11. What kind of common outdoor space or common outdoor areas does your residential unit have? (Please select all that apply.)

□ Backyard
□ A common outdoor area
□ A balcony or terrace
□ None

Section IV: Well-being

Physical Well-Being

4.1. What is your height? _____ ft _____ inches

4.2. How much do you weight? _____ pounds

4.3. Do you have any physical disabilities?

□ Yes □ No

4.4. My health is excellent.

□ Definitely true
□ Mostly true
□ Don't know

□ Mostly false
□ Definitely false

4.5. I seem to get sick a little easier than other people.

□ Definitely true
□ Mostly true
□ Don't know
□ Mostly false
□ Definitely false

4.6. In the past two weeks, have you had difficulty performing your work or other activities as a result of your physical health?

□ Yes
□ No

4.7. In the past two weeks, cut down the amount of time you spent on work or other activities as result of your physical health?

□ Yes
□ No

4.8. Have you ever been diagnosed with hypertension (high blood pressure)?

□ Yes
□ No

4.9. Have you ever been diagnosed with hypercholesterolemia (high cholesterol)?

□ Yes
□ No

4.10. Have you ever been diagnosed with diabetes?

□ Yes
□ No

4.11. Have you ever been diagnosed with respiratory illnesses and diseases (e.g., asthma, chronic bronchitis, lung cancer, pneumonia, etc.)?

□ Yes
□ No

4.12. Have you ever tested positive for the COVID?

□ Yes
□ No

Mental Well-being

Please indicate your level of agreement with the following statements. Please base your answers on how you felt in the last two weeks (please give the answer that comes closest to the way you have been feeling).

4.13. Have you felt too tired?

□ All of the time
□ Most of the time
□ A good Bit of the Time
□ Some of the time
□ A little bit of the time
□ None of the Time

4.14. Have you been a very nervous person?

□ All of the time
□ Most of the time
□ A good Bit of the Time
□ Some of the time
□ A little bit of the time
□ None of the Time

4.15. Have you felt so down in the dumps that nothing could cheer you up?

□ All of the time
□ Most of the time
□ A good Bit of the Time
□ Some of the time
□ A little bit of the time
□ None of the Time

4.16. Have you felt calm and peaceful?

□ All of the time
□ Most of the time
□ A good Bit of the Time
□ Some of the time
□ A little bit of the time
□ None of the Time

4.17. Did you have a lot of energy?

□ All of the time
□ Most of the time
□ A good Bit of the Time
□ Some of the time
□ A little bit of the time
□ None of the Time

4.18. Have you been on any prescribed medicine for depression or anxiety?

□ Yes
□ No

Social Well-being

Please indicate your level of agreement with the following statements.

4.19. During the past two weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

□ All of the time
□ Most of the time
□ Some of the time
□ A little bit of the time
□ None of the Time

4.20. If I want to go on a trip for a day (for example, to the country or mountains), it is easy to find someone to go with me.

□ Strongly agree
□ Agree
□ No opinion
□ Disagree
□ Strongly disagree

4.21. I usually enjoy attending parks and other public spaces to be around people and a part of the community.

□ Strongly agree
□ Agree
□ No opinion
□ Disagree
□ Strongly disagree

CURRICULUM VITAE

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EDUCATION

- Ph.D., Urban and Public Affairs, University of Louisville, 2023.
  Dissertation: Public Space and Well-being: An Empirical Study on Central Park in Old Louisville
- M.A., Urban Design, IAU Central Tehran Branch, Iran, 2014,
  Thesis: Recognition and Study of Meaning Indicators in Shaping Sustainable Urban Places (A Comparative Study between Naqsh-e-Jahan Square and Horton Plaza)
- B.A., Architecture, University of Science and Art, Iran, 2007
- A.A., Traditional Architecture, Kashan University, Iran, 2004

RESEARCH INTEREST

Public Space; Public Space and Well-being. Resilient Cities. Sustainable Built Environment. Meaning of Built Environment. Urban Design and Architecture. Place and Placelessness. Place-Making/Man-Place Relationship. Physical Environment, Memories, Notion of Home, and Immigrants

TEACHING EXPERIENCE

- University of Louisville: Sustainable Built Environment (Instructor, Spring 2023)
- University of Louisville: Sustainable Built Environment (Co-instructor, Spring, 2022)

- IAU of Isfahan (Iran): Exclusive Landscape Design (Instructor, Spring, 2014)
- IAU of Isfahan (Iran): Designing Urban Spaces (Instructor, Spring, 2014)
- IAU of Pardis (Iran): Design Principles II (Instructor, Spring, 2012)
- Khomeini-Shahr Governor's Office (Iran): (English Instructor, 2013)
- Mira Costa College, Oceanside, CA (Math, Spanish, and French tutor, 1996-1998)

PROFESSIONAL EXPERIENCE

- American Review of China Studies (United States): Managing Editor (2021-present)
- Farnahad Consulting Engineers Corporation, Isfahan (Iran): Urban designer/planner (2011-2015)

PUBLICATIONS

- Jamshidi, M. and Entezam, M. (2018). "A Study on Socio-Cultural Impacts of Development Plans", Jostarhay-e-Shahrsazi, Vol: 49, Spring and Summer. (In Persian)

- Entezam, M. (2015). "Defining Naqsh-e-Jahan Square with an Emphasis on Norberg Schulz's Place Phenomenology." (In English and Persian) https://independent.academia.edu/MaryamEntezam/Papers

- Entezam, M, Shali Amini, V, and Haghani, T. (2015). "Comparative Study of Meaning Components in Isfahan School in City Design and Place Phenomenology of Christian Norberg-Schulz." National Conference on Culture, Body and Environment in Islamic Architecture and Urbanism, December. (In Persian)

- Entezam, M. (2012). "Isfahan School of City Design; A Phenomenological Approach to Successful Humanitarian Growth." Poster accepted in International Conference; Urban Change in Iran; 8-9 Nov, University College London.

- Jalali, S., Darban Rezaei, E. And Entezam, M., (2011). "Façade Harmony in Infill Architecture in Distinguished Facades." Abstract published in National Conference of Facades and Landscape of the City Abstract Book, March. (In Persian)

WORKS IN PROGRESS

- Entezam, M. "Deliberation of Existential Insideness in Naqsh-e-Jahan Square with an Emphasis on Isfahan School in City Design"
- Translation into Persian*: Structure and Cooptition in Urban Networks,* Burger. M. J. (Under Review)

HONORS AND AWARDS

- Guest Speaker at UCSD, Subject: "Recognition and Study of Meaning Indicators in Shaping Sustainable Urban Places (A Comparative Study between Naqsh-e-Jahan Square and Horton Plaza)" at *City and Social Theory* Class on May 31st, 2018.
- Juror/Referee on Final Presentation of BA students at NewSchool of Architecture and Design, San Diego, CA. Dec. 2016.
- Letter of Excellence for master's Thesis, Feb. 2014.
- Certificate of Appreciation; Distinct English Instructor at Governor's Office, fall 2013.
- Second Award (The Silver Leaf) and Certificate of Appreciation for achieving the second place in the First National Contest of Tehran: "A Proposal for Tehran," Oct. 2013.
- Certificate of Appreciation; Outstanding Lecturer at IAU; Pardis Branch; Department of Urban planning, spring 2012.
- Honor Student at University of Science and Art, 2005-06
- Selected to receive EOPS scholarship on May 19, 1998.
- Awarded the Certificate of Appreciation for good standing in EOPS (Extended Opportunity Program and Services) at Mira Costa College in spring 1998.
- Selected to receive the Michael Giansiracusa scholarship in the amount of $350.
- Selected to Mira Costa College President's List: fall 1997, spring 1998.

LANGUAGES

- English (Fluent)
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