NEIGHBORHOOD CHILD-FRIENDLINESS: A COMPARATIVE ANALYSIS OF PARENTAL LANDSCAPE PERCEPTIONS AND GEOGRAPHIC INFORMATION SYSTEMS-BASED URBAN PLANNING INDICES

by

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DEDICATION

"All grown-ups were once children, but only few of them remember it."

Antoine de Saint-Exupéry, The Little Prince

To all grown-ups who still remember it.

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ABSTRACT

Urban planners have commonly leveraged geographic information technology to examine neighborhood landscapes and eventually provide a tool that policymakers could use for decision making. While these indices are very practical tools for measuring some aspects of a neighborhood's environment, they do not capture landscape elements rooted in the environment's firsthand experiences. The lay public's knowledge, known as local knowledge in the planning literature, has often been considered "belief" or "opinion" and therefore dismissed as planning practices rely mostly on technical knowledge and expertise. However, the increasing attention to the importance of public participation in planning highlighted the need to consider local communities' firsthand experiences putting pressure on urban planners to seek new ways of merging the science-based knowledge of expert planners with the contextual intelligence that only local communities possess. This dissertation research examines neighborhood child-friendliness by studying the differences between spatial models of three popular urban planning indices (expert knowledge) and the local community's perceptions who experience the same landscapes firsthand (local knowledge). This study uses a mixed-methods approach, including a) building a geographic information system (GIS) for the study area illustrating popular quantitative urban planning landscape indices related to child-friendliness, b) conducting an online survey of parents in the study area assessing their perceptions of child-friendliness characteristics for their neighborhood, c) conducting in-depth interviews with a geographically-dispersed, volunteer cohort of

parents in the study area, and d) quantitatively and qualitatively evaluating the differences between expert knowledge illustrations of child-friendliness and parental perceptions in Austin metro area in Texas. The integrated GIS use allows spatial examination of expert and local knowledge and generates insight regarding differences between these two viewpoints. The results of this research add to the emerging scholarship on the differences between expert and local knowledge in urban planning and inform practitioners and decision-makers engaged in developing and supporting child friendly urban landscapes.

1. INTRODUCTION

Community participation in planning remains a century-long dilemma for urban planners, policymakers, academics, and local citizens (Albrechts, Barbanente, and Monno, 2019). Due to financial, temporal, and political challenges, there tends to be an underlying concern among policymakers and planners about involving local communities in planning processes. However, the need to consider local communities' firsthand experiences puts pressure on urban planners to seek new ways of merging the science-based knowledge of expert planners with the *contextual intelligence* that only local communities possess (Corburn, 2003).

Traditionally, the lay public's knowledge, known as "local knowledge" in the planning literature, has often been dismissed as beliefs or opinions because planning practices rely mostly on technical knowledge and expertise (Rantanen and Kahila, 2008). Also, efforts to collect and incorporate local knowledge have not always been successful because of inadequate methods, lack of time, and lack of funds (Corburn, 2003). However, local communities' increasing concern for justice and experts' realization of local knowledge's crucial role in neighborhood planning have accentuated the need for practical participatory planning methods.

Urban planners have commonly used geographic information technology to examine neighborhood landscapes and provide tools that policymakers can use for decision-making. While these tools can be practical for measuring some aspects of a neighborhood's environment, they do not adequately capture landscape elements rooted in firsthand experiences. Thus, there is a need to explore how geographic information science (GISc) can be used to incorporate local knowledge, embedded in the

communities' perceptions and experiences, into urban planning processes (Rantanen and Kahila, 2008; Dunn, 2007; Sieber, 2006; Al-Kodmany, 2001; Talen, 2000).

Accordingly, this dissertation research examined neighborhood child-friendliness by studying the differences between spatial models of three popular urban planning indices (expert knowledge) and the local community's perceptions of who experience the landscapes firsthand (local knowledge). In addition, this dissertation used the concentrated disadvantage model, introduced by Sampson, Morenoff, and Earls in 1999, to examine neighborhoods' potential to generate social support for children (known as collective efficacy).

This study focused on parents of elementary school-aged children as the source for local knowledge. Evidence has shown that parental perceptions of the neighborhood environment have a major influence on children's use of the neighborhood environment (Prezza, 2007). Considering that child agency flows mainly through their parents/guardians, especially at younger ages, this dissertation examined parental perceptions of their neighborhoods through an online survey and follow-up interviews.

In summary, this study used a mixed-methods approach, including a) building a geographic information system (GIS) for the study area illustrating popular quantitative urban planning landscape indices related to child-friendliness, b) conducting an online survey of parents in the study area assessing their perceptions of child-friendliness characteristics for their neighborhood, c) conducting in-depth interviews with a geographically-dispersed, volunteer cohort of parents in the study area, and d) quantitatively and qualitatively evaluating the differences between expert knowledge illustrations of child-friendliness and parental perceptions in Austin metro area (Travis,

Hays, Bastrop, Caldwell, and Williamson counties) in Texas. The integrated GIS use allowed spatial examination of expert and local knowledge and generated insight regarding differences between these two viewpoints. The results of this research add to the emerging scholarship on the differences between expert and local knowledge in urban planning and inform practitioners and decision-makers engaged in developing and supporting child friendly urban landscapes.

2. PURPOSE STATEMENT

As also explained in the introduction, the purpose of this mixed-method research was to examine spatial models of neighborhood walkability, access to opportunity, and socioeconomic characteristics based on expert and local knowledge to understand differences between how urban planners' understanding of neighborhoods differ from the way parents perceive the same landscape in Austin metro. This study used GIS to visualize expert-driven indices and spatial distribution of parental perceptions and examined the difference between the two perspectives.

The Walk Score index was used to model walkability. Walk Score has been proven to be a valid and reliable measure of walkability (Carr et al., 2011; Duncan, 2011), and it has been widely used for scholarly research (e.g., Knight et al., 2018, Hirsch et al., 2013, Lwin & Murayama, 2011) as it is a primary measure of walkable access to a diverse range of amenities available for many places across the U.S. (Knight et al., 2018). The Child Opportunity Index (COI) was used as the expert-driven opportunity access model produced by the Institute for Child, Youth, and Family Policy at Brandeis University (diversitydatakids.org) and the Kirwan Institute for the Study of Race and Ethnicity as a measure of relative access to opportunity with a specific focus on child population. The third indicator was the Concentrated Disadvantage Index used to measure neighborhoods' potential for generating collective efficacy for children (Sampson et al., 1999).

Parental perceptions of walkability, access to opportunity, and social, organizational characteristics were gathered through an online survey and follow-up interviews with a group of parents recruited through Parent Teachers Associations

(PTAs) before the COVID-19 pandemic and Qualtrics data collection services after the pandemic. Parents answered questions regarding their neighborhood's walkability, access to opportunity, and social, organizational characteristics considering their children as users of the neighborhood environment. More in-depth information regarding the same topics was collected through virtual online interviews.

After modeling the expert and local knowledge, quantitative and qualitative analysis was conducted to model the difference between expert-driven indices and parental perceptions. Figure 1 shows the conceptual framework of what this research intended to accomplish by answering three main research questions stated in the next section.

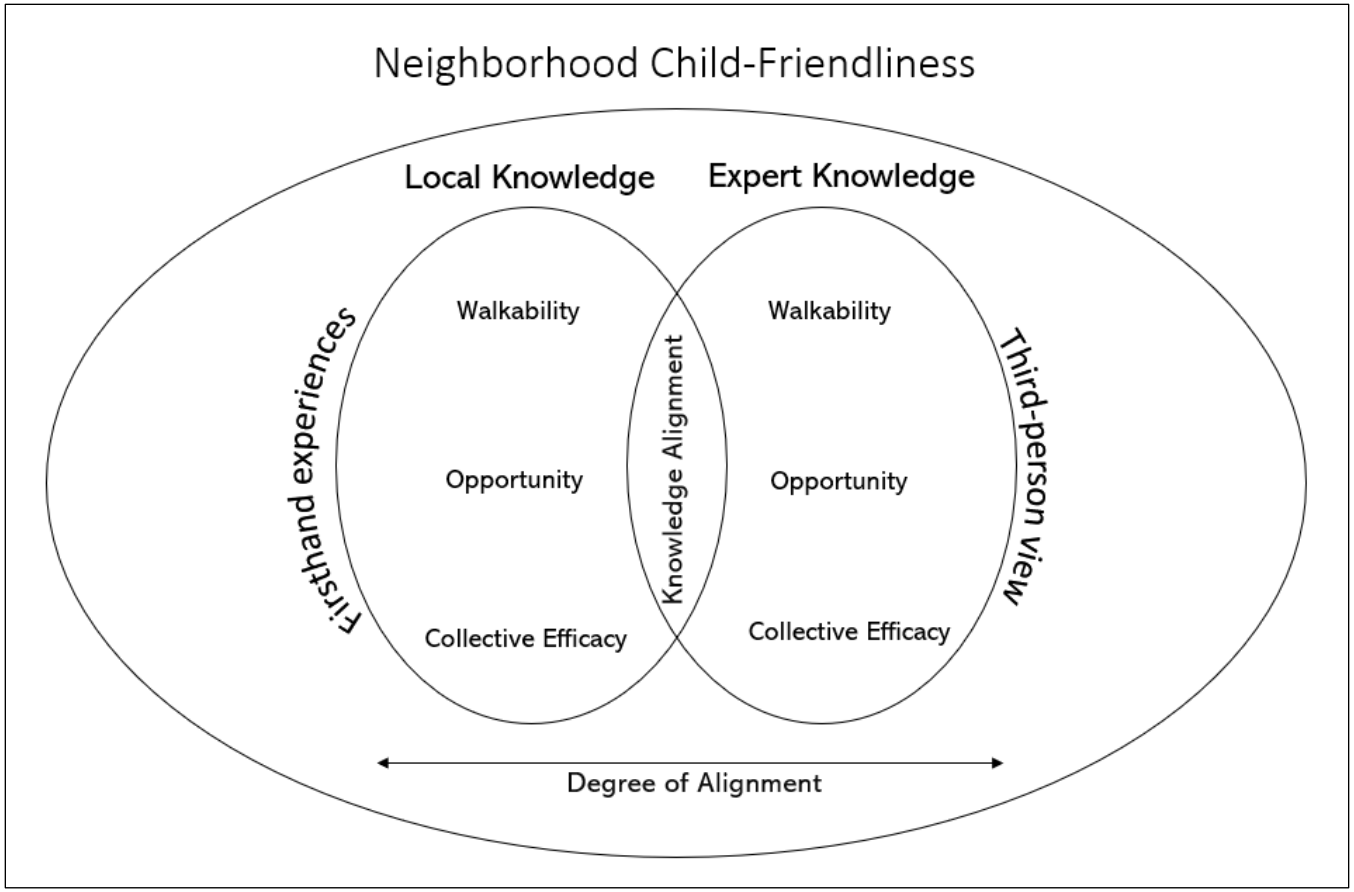

Figure 1. Conceptual Framework.

3. RESEARCH QUESTIONS

This dissertation research analyzed differences between expert models of urban landscape and perceptions of parents currently raising children in those same landscapes. The following research questions were used to accomplish the latter goal.

RQ1. What are the spatial characteristics of Austin's current *walkability*, *opportunity*, and *collective efficacy* indicators?

RQ2. How do Austin parents of elementary-aged children perceive walkability, access to opportunity, and collective efficacy within their neighborhood?

RQ3. What are the quantitative and qualitative differences between urban planning indices (expert knowledge) and parents' perceptions and experiences raising children within the study area?

The first research question was formed to understand the spatial characteristics of walkability, opportunity, and social organizational structures (i.e., collective efficacy) from the expert point of view. The second research question examined the same aspects of neighborhoods in Austin from parental perspectives. The final question captured the difference between the findings of the first and second research questions. The next chapter discusses the most relevant literature corresponding to these research questions.

4. LITERATURE REVIEW

This chapter provides the necessary background and context about the literature that formed the basis for this research. This chapter provides an overview of the relevant literature related to this dissertation's main themes, including expert and local knowledge, planning theories, existing child-friendliness frameworks, neighborhood walkability, access to opportunity, social organizational structure, and collective efficacy, focusing on child use.

4.1 Expert Knowledge and Local Knowledge in urban planning

The meaning of "local knowledge" and professional or "expert knowledge" has been discussed from a variety of perspectives (e.g., Geertz, 1983; Lindblom and Cohen, 1979). For this dissertation, local knowledge referred to the knowledge "often held by members of a community that can be both geographically located and contextual to specific identity groups" (Corburn, 2003, 421). This means that local knowledge can be generated by a group of people who have shared experiences related to a location (such as a neighborhood) and/or specific beliefs or interests. In the case of this dissertation research, local knowledge was considered the knowledge produced by a group of parents who experience the same landscape (school attendance zones) in relation to their perceptions of their neighborhood's child-friendliness.

By contrast, in this study, professional or expert knowledge referred to knowledge created by a group of people who belong to a specific profession or discipline (Corburn, 2003). Expert knowledge is often produced from a third-person perspective using systematic data collection and analytical techniques to examine the situation under study as opposed to local knowledge that is generated through everyday life experiences of

people who live that specific situation firsthand or in relation to people close to them (Corburn, 2003). Indeed, local knowledge does not always conform to technical rationality and universal theories used by experts to find the "truth" (Corburn, 2003; Habermas, 1970). As a result, expert planners' approaches to problem-solving may not represent people's perceptions and experiences in increasingly diverse urban communities (Sandercock, 1999).

Many benefits have been associated with residents' involvement in the planning process (Blanchet-Cohen, 2014). Also, multiple theories and strategies have emerged in response to these challenges, such as communicative planning (ex. Mc-Guirk, 2000) and participatory planning (ex. Brabham, 2009). Other than being a sign of a democratic process (Brabham, 2009; Lane, 2005; Sewell and Coppock, 1977), public participation in planning and decision-making has been encouraged as a way to increase the assurance that the plan will be representative of diverse communities, thus become accepted by a broader group of users (Creighton, 2005). Residents' intimate knowledge of their neighborhood can generate new knowledge, different perspectives, and creative solutions to actively shape planning processes and techniques (Brabham, 2008; Lakhani and Jeppesen, 2007).

Contrary to the hierarchical structure in traditional planning processes, contemporary planning encourages collaboration as a network that considers both expert and local knowledge equally important (Innes, Connick, and Booher, 2007). Contemporary planning aims to listen to all unheard voices and lay or local knowledge (Rydin, 2007). However, planners face a variety of challenges in their attempts to incorporate local knowledge.

Reaching out to local communities and attracting participation is one of the main challenges (Seltzer and Mahmoudi, 2013). Indeed, it could be burdensome to ask citizens to spend their free time participating in planning meetings while there is a range of other ways they may prefer to spend their time (Seltzer and Mahmoudi, 2013). Also, participatory strategies can be time-consuming and relatively expensive. It can also be challenging for planners to handle multiple sources of knowledge and ultimately use the informal knowledge in a combination of expert knowledge to influence decision-making (Rydin, 2007).

4.2 Planning Theories and The Concept of Knowledge in Planning

The rational comprehensive planning theory

Over the years, urban planning theories have substantially changed the concept of "knowledge." In the 1950s and 1960s, urban planning was predominantly based on synoptic or the rational comprehensive planning theory (Mäntysalo, 2005). Scholars applied planning theory to examine urban problems from a system-oriented view, relying mainly on mathematical models and quantitative analysis (Hudson, Galloway, and Kaufman, 1979). Thus, this planning theory collects quantifiable factors such as age, income, population density, distance to amenities, etc. As John Forester stated, an urban planner's role is to "rely only on facts that have a scientific basis and, on the authority, and duties designated to your public office position" (Mäntysalo, 2005).

Being heavily influenced by the traditional approach to science, the rational comprehensive planning theory often resulted in a dualistic view of observer-observed or expert-user (Mäntysalo, 2005). This view is rooted in a definition of knowledge as an

entity held and produced by experts through procedures that ensured objectivity (Rydin, 2007), leaving no room for participation. Within this framework, expert planners are considered neutral observers of urban problems with valid knowledge and the ability to analyze the problem and produce a comprehensive solution. Even though this view has lost much of its theoretical validity over the years, some ideas are still at the core of today's urban planning practice (Mäntysalo, 2005). As Hudson (1979) argued, the real power of rational comprehensive planning theory is its simplicity. Mathematical models and quantitative methods, in general, are straightforward and replicable. These are some important reasons why this planning theory is still in use.

Advocacy Planning Theory

Advocacy planning theory emerged in the 1960s (Hudson et al., 1979), a decade influenced by social activism, environmental, and civil rights movement. In such a context, the driving idea of advocacy planning was focused on whom the planners are working for rather than what planners do (Connell, 2010). Indeed, planners were seen as advocates for unheard voices, and planners' work should protect marginalized groups against corporate and government's established power (Heskin, 1980). Under this definition, an urban planner's work is guided by values based on a moral system rather than systematic science.

Davidoff (1973) contended that in a pluralistic society (i.e., a society created by a diverse range of interest groups), planning could not be based on mere objective scientific values. Over the years, advocacy planning demonstrated some success, especially in opposing insensitive plans and the traditional view of one-dimensional planning (Hudson

et al., 1979). Simultaneously, advocacy planning has been criticized for blocking plans without providing constructive and effective alternative plans (Peattie, 1968). With all its limitations, advocacy planning created the basis for more community-oriented planning approaches that came after it.

Incremental Planning Theory

In 1965, Charles E. Lindblom introduced partisan mutual adjustment theory known as incremental planning theory (Hudson et al., 1979). This planning theory was presented in opposition to synoptic or the rational comprehensive planning theory and advancement of the advocacy theory. Some criticism against the comprehensive rational theory regarded its reductionist nature and its insensitivity to the diversity of values (Hudson et al., 1979). In the same vein as advocacy theory, incremental planning theory aimed to include diverse groups' interests into the planning agenda and reach an agreement between all conflicting interests (Mäntysalo, 2005). Lindblom described this planning theory as partisan mutual adjustment, a negotiation strategy to achieve compromises and decisions among all interest groups. Lindblom argued that an ideal solution was a Pareto optimum — a solution to the majority's advantage and a loss to none (Mäntysalo, 2005). Lindblom thus considered a decentralized strategy to suit a democratic society and a free market in the USA (Hudson et al., 1979). Like advocacy theory, the incremental theory has also been criticized for focusing mostly on planning's political aspect, leaving the technical and practical aspects more uncertain (Mäntysalo, 2005).

Communicative Planning Theory

Similar to incremental planning theory, Communicative Planning Theory (CPT) builds upon criticisms against traditional rational planning's epistemological basis. Having its roots in the “Theory of communicative action” of Habermas and his colleagues in 1984, CPT involves collaborative processes of creating consensus around shared experiences and perceptions grounded in a dialogue (McGuirk, 2001). According to Habermas, three criteria are needed to achieve this goal: propositional truth, normative rightness, and subjective truthfulness (Mäntysalo, 2005). Thus, plan outcomes would not be generated through an instrumental and strategic process rather through argumentation and finding common grounds among the stakeholders. As Forester (1989) states, in this context, planning becomes a “deeply social process of making sense together” (McGuirk, 2001).

One of CPT's main critiques concerns the unequal power relations that can affect the plan outcomes (Mäntysalo, 2005). Although CPT considers planning a technical and political process, it requires that power relations are set apart during argumentation. In other words, debates should occur in the context of a deliberative power-neutral forum where power inequalities are temporarily excluded (McGuirk, 2001). Thus, the planner’s main role would be to act as a “critical friend” (Healey, 1997). However, critics of this theory are skeptical about the attainability of power-neutral consensus and planners' consideration as critical friends. While CPT seems to have a strong theoretical framework, it is not sure to be properly executed in practice.

Collaborative Planning Theory

The concept of consensus, developed within communicative planning theory, has

led to the emergence of new planning theories and approaches, including Collaborative Planning Theory introduced by Healy (1997). Building on the critiques of communicative theory, collaborative planning is focused on the practical aspect to serve as both a theoretical framework and as a practical action framework (Harris, 2002). However, there are debates regarding whether collaborative planning can be considered a theoretical framework or a theory of practice (Tewdwr-Jones and Allmendinger, 1998).

Participatory Planning Theory

Participatory planning Theory (PPT) builds upon the collaborative and communicative planning theories calling for more participatory and inclusive planning processes (Legacy, 2017). This theory focuses on how to improve citizen participation in planning as a political action effectively. Generally, the main concern with participation has been ensuring communities of color and disadvantaged groups are included in the process. Thus, particular attention has been given to understanding the interplay between citizen participation and experts' decision-making to provide citizens with a participation platform such as large-scale town hall meetings, citizen juries, and decision-making panels (Legacy, 2017).

The discussion regarding participatory methods and ways to improve the current techniques and strategies is still ongoing among scholars. There has been much debate about how participatory planning methods effectively improve public engagement in the planning processes (Lennon, 2017; Inch, 2015). Many questions have been raised about what participation is, who should participate in the benefits, and who benefits from participation the most (Cornwall, 2008).

The highly cited work of Cornwall (2008) provided a comprehensive explanation

of typologies of participation originally introduced by Arnstein (1969), Pretty (1995), and White (1996). Arnstein provided a participation ladder from the non-participation stage to a stage in which citizens have the power of control. The middle stage was tokenism that refers to citizens' participation in the form of consultation, meaning that citizens are consulted for their ideas, but their ideas have little influence on the final decisions. Sometimes final decision-making has already taken place before consulting with citizens; Pretty's (1995) classification of participation starts with manipulative and passive participation types to the final stage, “self-mobilization,” in which citizens take the initiative independently of institutional power. White (1996) provided a similar classification starting from the “nominal” participation that its only function is to put a stamp of legitimacy on the decisions already made, to a stage called “transformative” participation, in which citizens are empowered and enabled to make their own decisions and take actions.

Despite the clear theoretical distinction between the typologies of participation, distinguishing various participation stages does not result in practice. Part of the ambiguity of these boundaries is the engagement of many actors in participatory processes who may have different perceptions of what “participation” is and how it should be implemented (Cornwall, 2008).

4.3 Child Friendliness Concept

The increased attention to the importance of neighborhood environments on children’s outcomes has led to a substantial body of interdisciplinary research examining neighborhood effects ranging from physical to social and economic aspects (Bradley and Corwyn, 2002; Diez Roux, 2001; Leventhal and Brooks-Gunn, 2000; Solon, Page, and

Duncan, 2000; Furstenberg and Hughes, 1997; Coulton and Pandey, 1992).

In 1992, the idea of child friendly cities was introduced in the mayor's Defenders of Children (MDC) framework, launched by UNICEF in Dakar, Senegal. This partnership initiative aimed to encourage city authorities to prioritize the well-being of lower-income women and children by increasing their investments in child-centered programs. In 1996, UNICEF introduced the Child Friendly Cities Initiative (CFCI) at the UN-Habitat II Conference in Istanbul (UNICEF, 2019). The goal of this initiative is to encourage local governments to pay closer attention to children's rights and treat them as "human beings with a distinct set of rights instead of as passive objects of care and charity" (UNICEF, 2019).

Many researchers have focused their analysis on the child friendliness concept's multi-dimensionality on specific aspects of child-friendliness such as safety, pedestrian friendliness, and access to green space and playgrounds. Despite similarities in the results, sometimes there has been a lack of agreement between objective and perceived measures, which may be due to these methods' capability to capture only certain aspects of the problem (Leslie et al., 2010; Tilt et al., 2007). For example, due to the positive health effects of exposure to green open space, scholars have used several methods to measure neighborhood greenness, including objective measurement of greenness by using satellite imagery and remote sensing analysis (Rhew et al., 2011), GIS (Browning and Lee, 2017), and auditing (Giles-Corti et al., 2005), or through the use of survey and interviews to measure perceived neighborhood greenness (Sugiyama et al., 2008). These methods have helped shed light on a different aspect of urban greenness within different neighborhoods.

The next section of this chapter will discuss the relevant literature about the existent child-friendliness frameworks and the relevant social and physical structure, emphasizing neighborhood child-friendliness. The respective features represent the built environment from the physical and social perspective aiming to draw a realistic picture of neighborhood child-friendliness.

4.4 Existing Child-Friendliness Frameworks

The concept of child-friendliness in the academic literature have been discussed and analyzed under different themes such as active transportation, independent mobility, the impact of urban features on children's physical activity, access to green spaces and playground, safety, and children's active participation in decision-making processes (Freeman and Tranter, 2012). Several publications such as *Growing Up in an Urbanizing World* (Chawla, 2016), *Creating Better Cities with Children and Youth* (Driskell, 2001), *Building Better Cities with Children and Youth* (Bartlett, 2002), *Youth in Cities* (Tienda and Wilson, 2002), *Children in the City: Home Neighbourhood and Community* (Christensen and O'Brien, 2003), T*he Growing Up in Cities Project: Global Perspectives on Children and Youth as Catalysts for Community Change* (Chawla and Driskell, 2006), *Introduction: Young People's Im/Mobile Urban Geographies* (Skelton and Gough, 2013) have all focused on improving children's quality of life within the urban environment by proposing a shift to more child-centered policies and integration of child's view in the decision-making processes.

The 1996 UNICEF's Child Friendly Cities Initiative inspired many scholars to examine how environmental features affect children's lives from a child's rights perspective. (e.g., Malone, 2001; Riggio, 2002; Corsi, 2002; Woolcock, Gleeson and

Randolph, 2010). Many of these studies examined child-friendliness from a subjective perspective using qualitative methods, including surveys and interviews. Qualitative GIS is another popular method for collecting children's perceptions of their neighborhoods' environmental characteristics (e.g., Wridt, 2010).

A few scholars, including Broberg, Kyttä, and Fagerholm (2013), Horelli (2007), and Chaterjee (2006), have studied child-friendliness more systematically by proposing a framework with a set of criteria for a more operationalized assessment of child-friendliness. Chatterjee (2005) studied whether there could be a friendly relationship between children and their everyday physical environment based on Doll's (1996) six essential conditions of friendship: mutual affection and personal regard; shared interests and activities; commitment; loyalty; self-disclosure and mutual understanding; and horizontality. Later, in 2006, in her dissertation research, Chatterjee proposed a theoretical framework for environmental child-friendliness from a socio-physical perspective based on the place friendship theories. According to this framework, a child friendly place should 1) provide opportunities that allow children to develop love, respect, and care for the place; 2) encourage a child-place exchange through the provision of actualized opportunities; 3) provide environmental opportunities through direct experiences for children to learn about the environment and develop relative competence; 4) give children the possibility to create their territories and protect them; 5) allow children to experience the privacy and have secrets, and 6) provide the opportunity for children to express themselves freely. As part of her dissertation research, Chatterjee worked with children in New Delhi to find their important places' common characteristics. Based on her findings, she collapsed dimensions 4 and 6 under a broader

vision of dimension 2 as “meaningful exchange with the place,” which gathers distinct aspects of children’s exchange with the outdoor environment.

In 2007, Horelli presented another framework to describe child-friendliness, rooted in theories of good governance. This framework represented ten dimensions of a good environment based on a view of a child’s life as a physical, psychological, social, cultural, economic, and political being. These criteria included ten normative dimensions, including housing, basic services, participation, safety and security, family and community, physical environmental qualities, accessibility to resources and poverty reduction, ecology, sense of belonging, and participatory governance.

These criteria were used to survey a group of youth (13-18 years old) in Finland, whose responses indicated the importance of accessibility to services, safety, community, and physical environmental qualities over other dimensions (Horelli, 2007). For example, one study found that children showed higher attention to basic services (in terms of recreational structures), and safety (in terms of the absence of traffic), and autonomous mobility (Haikkola, Pacilli, Horelli, & Prezza, 2007). Their parents, however, were more concerned about the safety issue in terms of social dangers. Chawla and Driskell (2006) found similar results in the *Growing Up In Cities project,* with basic services and safety most relevant among other characteristics of a child friendly environment.

A more systematic and operationalizable child-friendliness framework, the Bullerby model, was introduced by Kyttä in 2006 and revisited by Broberg, Kyttä, and Fagerholm in 2013. According to this framework, child-friendliness is defined based on two main criteria: 1) the degree to which children can move independently and 2) diversity of environmental opportunities (affordances) available to children. The

covariation of these two criteria can generate four types of children's environments (Figure 2).

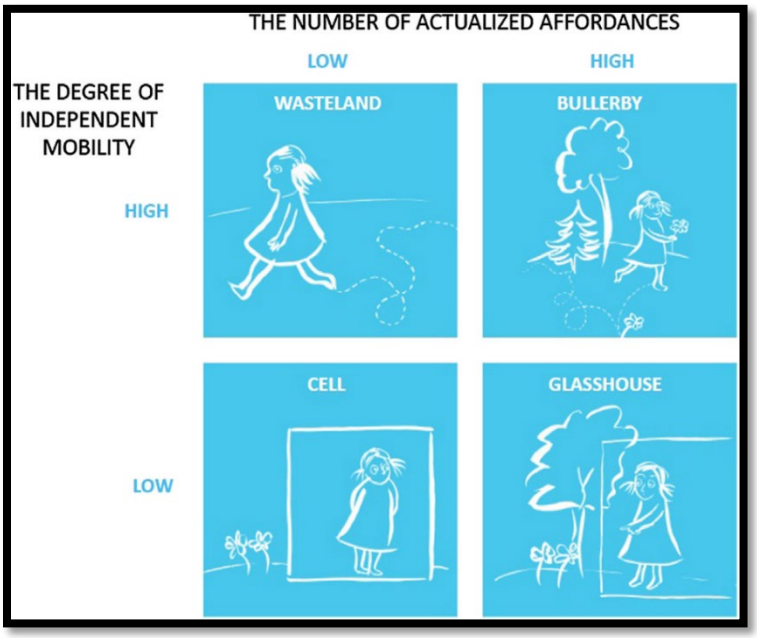

Figure 2. The Bullerby framework by Broberg et al. (2013).

According to this model, the Bullerby type of environment represents the highest level of child-friendliness, which provides a greater opportunity for a child to move independently, thus having access to a larger and more diverse variety of affordances (creating a positive cycle). By contrast, there is the Cell environment, in which children have a minimum (or no) opportunity to move independently and actualize diverse affordances. Thus they cannot form a personal relationship with their environment. The Wasteland scenario happens when the environment allows for independent mobility but in a monotone environment with minimum/no possibility for the actualization of a diverse variety of affordances. Lastly, the Glasshouse type describes a situation where the environment provides diverse affordances, and the child can even be aware of them but

does not get the opportunity to actualize them independently. The Glasshouse situation is common in urban areas in developed countries where children are exposed to various opportunities, but due to mobility limitations imposed by parents or sometimes by communities, children cannot leverage those affordances independently.

Broberg, Kyttä, and Fagerholm (2013) used quantitative and qualitative GIS to test the Bullerby model through a case study in Turku, Finland. They aggregated the point data of the affordances to a grid and analyzed their diversity level for each cell using the Shannon diversity index, a commonly used index in ecology and social science research. The proportion of green structures, residential density, floor area ratio, and the population was selected as GIS variables to measure child-friendliness within a 50-m buffer of marked affordances on the map, which, combined with children's actual experiences, drew a more precise picture of child-friendliness within the study area. As mentioned previously, this study has presented one of the most operationalizable models leveraging GIS techniques in examining place child-friendliness.

The following section of this chapter discusses the two main dimensions of child-friendliness (CF) presented in the Bullerby model. Also, it will highlight the factors playing a key role in making a neighborhood more child friendly from the physical environmental aspect and the social aspect.

4.5 Active Transportation and Independent Mobility

Active transportation refers to any form of transportation that provides an opportunity for physical activity (Sallis et al. 2004). Walking and cycling are the most common, affordable, and environmentally sustainable forms of active transportation available to children. Children can use their daily travel to school as an opportunity to

practice active transportation and engage in physical activity, which can be independent or with the adult present (Larsen, Buliung, and Faulkner, 2016; Temperio et al., 2006).

The long-term positive effects of regular physical activity on children's physical and mental health have been extensively reported in the literature (Biddle and Asare, 2011; Colley et al., 2011; Loon and Frank, 2011; Janssen and LeBlac, 2010; Boreham and Riddoch, 2001). The results of several studies showed that children who walk or bike to school are more likely to be physically active after school (Cooper et al., 2003) and have better cardiovascular fitness than those who do not actively commute to school (Davidson, Werder, and Lawson, 2008). If this activity is unsupervised (independent mobility), it can also increase children's opportunities for independent problem solving and socialization, positively influencing their cognitive development (Prezza and Pacilli, 2007). On the contrary, increasingly sedentary lifestyles among children and declines in active commuting to school have led to the early onset of various types of chronic diseases and increased childhood obesity (Trost et al., 2001; Janssen and LeBlanc, 2010).

Rapid urbanization and the pressure of a neoliberal market-centric culture have changed neighborhoods' structure over time, leading to an increased dependence on cars and the loss of many neighborhood destinations (e.g., local shops). Thus, despite extensive benefits associated with active independent mobility to school, there has been a significant decrease in active and independent commuting to school among children in the United States (Hu and Reuscher, 2004) as well as other developed countries over the past few decades (Merom et al., 2006). As a matter of fact, in 1969, 48 percent of K-8 students walked or bicycled to school in the US, while, in 2009, only 13 percent of K-8 students walked or bicycled to school (National Center for Safe Routes to School, 2017).

The decline in active commutes to school has been confirmed by other studies, including a 2007 study that found that when children were asked to take a picture of their typical week, more than half of them drew the back seat of their family car (Malone, 2007).

There are multiple factors for which parents decide or feel obligated to drive their children to school. These factors can be broadly grouped into three realms: individual, social, and physical (Zhu and Lee, 2009). Age, gender, race/ethnicity, and income are within the most common individual, and demographic factors reported to have a connection with children's active commute to school (Giles-Corti et al., 2005). Many studies found older children to be more likely to engage in active traveling to a school than younger children who might be more dependent on adults (Mitra et al., 2014; Mammen et al., 2012 Evenson et al., 2006). These results are quite intuitive as older children may be more independent due to their physical and mental maturity. Gender-wise, boys are more likely to walk to school than girls (Cooper et al. 2003) even though this binary view of gender might not be accurate as it omits to consider gender diversity among children (Buliung et al., 2017).

Income is another factor considered to have an impact on children's active transportation. It has been found that the rate of active commutes to school is lower among children in families with a higher socioeconomic status (Larsen, Gilliland, and Hess, 2012), while children from a lower socioeconomic status tend to walk more often to school (Ewing, Schroeer, and Greene, 2004, Evenson et al., 2006), which can be explained in part because some lower-income families may not be able to afford a car. Despite higher rates of walking in neighborhoods with lower socioeconomic status than higher socioeconomic neighborhoods, some studies have found that pedestrian

infrastructure and safety levels are significantly lower in low socioeconomic status neighborhoods (Zhu and Lee, 2008).

Distance has been frequently identified as a barrier for children's active and independent mobility (Giles-Corti et al., 2011; Loon and Frank, 2011; Zhu and Lee, 2008). Longer distances to school can negatively influence a child's willingness to walk and a parent's willingness to allow children to walk. Also, long-distance is associated with greater exposure to social dangers, which directly influences parental decision to oppose independent child mobility (Whitzman et al., 2010; Prezza et al., 2009; Carver, Temperio, and Crawford, 2008; Björklid and Nordström, 2007; Prezza et al., 2005).

However, distance alone is not the only factor influencing active child mobility as the statistics reported by the National Center for Safe Routes to School (2017) showed that the percentage of K-8 children living within one mile of a school and walked or cycled to school declined to 35 percent in 2009. Other correlations of active child commuting include crime rate, traffic safety, and pedestrian infrastructure quality such as sidewalks and street lighting (Zhu and Lee, 2008; Timperio et al., 2006). Additional factors identified by previous studies include land-use diversity, street connectivity, density, greenness, aesthetic features, and air pollution proved to be effective for encouraging child's independent and active travel to school (Giles-Corti et al., 2013; Zhu and Lee, 2008; Bringolf-Isler et al., 2008; Carver, Temperio, and Crawford, 2008; Kerr et al., 2007; De Varies et al., 2007; Frank et al., 2007).

Despite the general agreement on the importance of some of the above-discussed factors, the results have not always been consistent about the extent and the way these factors influence active child transportation. For example, while mixed-land use and

higher street connectivity have been associated with a positive influence on active child commuting (Villanueva et al., 2014; Broberg, Salminen, and Kyttä, 2013), other studies found these factors to have the opposite effect on children's walking (Easton and Ferrari, 2015; Timperio et al., 2006). Another study found that connectivity positively influences a child's active commute to school where streets are local, but highways, railroads, and other major roads can negatively affect children's active commuting to school (Easton and Ferrari, 2015). The diversity of these results demonstrates the complexity involved in understanding. Active child mobility, which is influenced by several individual and environmental factors and diverse contexts and geographies where this topic has been studied.

4.6 Walkability Measures

There is a large body of literature examining which aspects of the built environment influence neighborhood walkability concerning adult-use (Wang et al., 2016; Glazier et al., 2014; Turrell et al., 2013; Giles-Corti et al., 2013; McCormack and Shiell, 2011) as well as child use (Easton and Ferrari, 2015; Larsen, Gilliland, and Hess 2012; Kerr et al., 2007; Ewing, Schroeer, and Greene, 2004).

Measures of walkability are often representative of either the pedestrian-friendliness of a neighborhood or a specific route, such as a school route and accessibility of various amenities within a community. Previous research has used GIS to examine walkability for individual study settings such as a certain neighborhood or a specific route. Three methods frequently used to objectively measure the physical environment's walkability are neighborhood buffers, the shortest path, or the mapped routes (Buliung et al., 2017). Each of these methods or a combination of them leads to various algorithms.

Thus, various results can explain how the physical environment correlates with traveling behavior (Larsen, Buliung, and Faulkner, 2016).

While some of these methodologies have effectively measured walkability, they are mostly limited to specific case studies and population groups. Due to the distinct characteristics of a place or population group factors, most of these methodologies cannot be generalized. Using these methodologies at a large scale would require significant financial and human resources for the data collection and analysis. Therefore, despite these advancements, simplified methods that use secondary data sources are more popular in the political arena.

These walkability indices, mostly developed by expert urban planners, are not focused on a specific group or study area. These indices were created to be more practical and convenient to use by the general public and governmental entities, and the walkability score is generated mainly based on the walking distance to nearby amenities. One of the most popular and frequently used walkability indices is the Street Smart Walk Score (Walk Score). Walk Score has been promoted as a free, fast, and easy to use proxy of neighborhood walkability and access to nearby amenities (Carr et al., 2010). It has been widely used across the U.S. by real estate agencies (e.g., Redfin.com), researchers (e.g., Camhi et al., 2019), non-profit organizations (e.g., AmericaWalks.org), and governmental entities (Moudon, 2020). Walk Score will be discussed in more detail in the methodology chapter because it is the index used to evaluate the neighborhood walkability from the experts' view.

4.7 Spatial Access to Opportunity

The concept of access to opportunity has been a focus of study in social sciences

for decades. In 1995, Glaster and Killen coined the term “geography of opportunity,” which has attracted policymakers' interest in how the opportunity is distributed across urban areas and what factors influence opportunity structures (Knaap, 2017). However, despite the increasing attention, this complexity is associated with the concept of opportunity has prevented the scientific community from reaching a consensus on how opportunity should be defined and measured (Knaap, 2017).

Conceptually, the opportunity has been intertwined with the notion of equity. According to Toulmin (1988) and later Talen (1998), and Talen & Anselin (1998), equity was defined in terms of access or proximity to various public amenities and neighborhood features (Knaap, 2017). The way opportunity mapping is most often operationalized is mainly based on the housing model developed by John Powell (2003). That model was later used in Thompson v HUD (Powell, 2005) to show that segregation of African American public housing residents in Baltimore City had isolated them from accessing essential opportunities (Knaap, 2017). Powell’s composite opportunity index included three categories: education, economic, and mobility. It showed the disproportionate concentration of people of color and public housing in lower opportunity areas.

The connection between opportunity and equity has been explored in many studies. For example, several studies found that lower-income neighborhoods and communities of color have more restricted access to supermarkets and larger grocery stores (Hilmers, Hilmers, and Dave, 2012; Walker et al., 2010; Larsen, Story Nelson, 2009; Morland et al., 2006). Other studies examined the disparities and inequalities in terms of access to parks and playgrounds (Crawford et al., 2008; Talen and Aneselin,

1998), primary health care (McGrail & Humphreys, 2014; McGrail, 2012; Bagheri, 2005), and education (Wen et al., 2018; Gao et al., 2016).

Measuring Opportunity

In geography, spatial access to opportunity generally refers to the level of ease with which people in a neighborhood can reach certain opportunities (Hewko, Smoyer-Tomic, and Hodgdon, 2002; Kwan, 1999). Researchers have extensively studied spatial access to an individual category of opportunity, including healthy food (Smith et al., 2009; Larsen and Gilliland, 2008; Morland, Diez Roux, and Wing, 2006; Zenk et al., 2005), health care (Delamater, 2013; Luo and Qi, 2009; Luo and Wang, 2003), schools (Talen, 2001), parks and playgrounds (Reyes, Páez, and Morency, 2014; Potestio et al., 2009; Talen and Anselin, 1998).

Due to the complexity of the concept, researchers must select a series of indicators as proxies in order to be able to measure access to opportunity quantitatively. For example, supermarkets have been frequently used as a proxy for access to healthy food (Larsen and Gilliland, 2008). Indeed, several studies found a positive association between supermarkets' presence in neighborhoods' vicinity and lower obesity rates (Cummins and Macintyre, 2006; Morland, Diez Roux, and Wing, 2006). It is important to note that access depends on several individuals and societal factors than supermarkets' mere presence. For example, the finding that socioeconomically disadvantaged youth are at higher risk of obesity (Casey et al., 2012) might be partly related to supermarkets' absence in their neighborhood vicinity. However, it could be related to greater fast-food consumption (Smoyer-Tomic et al., 2008).

The literature presents a variety of methods and algorithms used to create

measures of spatial accessibility to amenities. These methods include less complex traditional measures such as proximity and supply-demand ratio and more complex measures including kernel density (KD), time-space analysis, and gravity models (e.g., two-step floating catchment area). The demand-supply ratio method is used to measure the accessibility to a certain amenity by calculating the demand based on the supply in a given study area. Instead, the proximity method characterizes access based on distance measured in proximity to the closest amenities, the average distance to a certain number of service providers, or the average number of amenities or service providers within a certain distance buffer.

Although both measures are commonly used to measure accessibility, they only account for certain aspects of accessibility while ignoring other aspects (Kwan, 1999; Yang, Goerge, and Mullner, 2006). The demand-supply ratio method assumes that people living within a region have equal access to the services within that region (Luo and Qi, 2009) and that they do not interact with service providers beyond the boundaries of their region (Kleinman and Makuc, 1983; Wing and Reynolds, 1988; Yang, Goerge, and Mullner, 2006). Proximity-related measures consider only the aspect of travel distance (McLaughlin and Wyszewianski, 2002) and tend to ignore other supply-related aspects, such as higher quality of service or shorter waiting time, which may influence people's decisions to travel farther (Yang, Goerge, and Mullner, 2006).

With more sophisticated geospatial techniques, the combination of the demand-supply method with the proximity method has led to more effective measures, known as gravity models (Luo and Wang, 2003). The gravity models are driven from Newton's Law of Gravitation, originally used in land use planning (Hansen, 1959) and prediction of

retail travel (Reilly, 1931). A type of gravity model, known as a two-step floating catchment area (2SFCA), is frequently used to measure spatial accessibility to health care amenities. This method's major limitation is that each catchment area is considered at a fixed distance, with no attention to the type of facilities, which does not reflect how some amenities are planned (Dony, Delmelle, and Delmelle, 2015). In the case of parks, accessibility has been measured through methods such as population-weighted distance (PWD) developed by Zhang, Lu, and Holt (2011) and "accessibility in the context of spatial disparity (ASD) introduced by Lee and Hong (2013), which may be more applicable to this context (Dony, Delmelle, and Delmelle, 2015).

Similar to the discussion regarding walkability indices, the methodologies discussed above are mostly used to measure access to opportunity in a specific study area. Applying these methods to larger study areas would require significant financial and human resources to collect the required data and conduct analysis. As a result, composite indices that use mainly secondary data, such as census data, have become more popular for measuring opportunity in larger study areas. Due to their practicality, composite indices that measure multiple dimensions of opportunity are popular among urban planners and attractive to policymakers. Interpreting a composite index often appears to be more straightforward for the general public than making sense of a series of separate indicators. Thus, a composite index's goal is often to simplify understanding a complex concept and operationalize its measurement (Greco et al., 2019).

A composite index is often developed in several stages, and multiple statistical and mathematical techniques are used to generate a final number that is meaningful and helps interpret a complex concept (Greco et al., 2019). Many opportunity indices are

created by calculating the z-score for each spatial indicator and then aggregating the scores into a certain scale, usually collapsed into a 5-category index (Knaap, 2017). Like all statistical and mathematical models, scholars recommend that opportunity indices need to be treated with skepticism, and their limitations should be acknowledged.

In the first place, it is important to consider that the construction of a composite index involves assumptions. If the relative assumptions are not made carefully, the final index may become misleading (OECD, 2008). Another potential limitation of composite indices is related to the weights assigned to each factor (Dialga, 2017). The critics of composite indices indicate that because selecting certain weights is mainly subjective with no empirical evidence, the final index may not reflect the underlying concept's reality (Greco et al., 2019). Also, there is skepticism in the way data are aggregated. Some scholars believe that aggregating data is statistically meaningless (Sharpe, 2004).

In addition to the other methodological limitations, data visualization can become a limitation when mapping opportunity areas. The quantile classification method is commonly used to visualize the final scores as this classification produces distinguishable patterns and appealing aesthetics by assigning equal share for each color (opportunity level) on the map. However, from an analytical view, maps classified based on quantiles can be deceptive because the imposed distribution may not represent the underlying data’s distribution (Knaap, 2017). Also, by treating outliers like common observations, the quantile distribution may misshape the truth underlying the data.

Despite all the critiques, the composite indicators have become popular in all areas of research and practice, and the number of them has been increasing every year (Bandura, 2006). Thus, the Organization for Economic Cooperation and Development

(OECD) provides a comprehensive technical guideline for creating composite indicators for researchers, policymakers and media, to provide best practices and increase transparency. They also summarize the main advantages and disadvantages of using composite indicators, adapted from Saisana and Tarantola (2002), as shown in Table 1.

Table 1. Advantages and Disadvantages of Composite Indicators (Adapted from Saisana and Tarantola, 2002).

Advantages	Disadvantages
Can summarize complex, multi-dimensional realities to support decision-makers. Are easier to interpret than a battery of many separate indicators. Can assess the progress of countries over time. Reduce the visible size of a set of indicators without dropping the underlying information base. This makes it possible to include more information within the existing size limit. Place issues of country performance and progress at the center of the policy arena. Facilitate communication with the general public (i.e., citizens, media, etc.) and promote accountability. Help to construct/underpin narratives for lay and literate audiences. Enable users to compare complex dimensions effectively	May send misleading policy messages if poorly constructed or misinterpreted. May invite simplistic policy conclusions. May be misused, e.g., to support the desired policy, if the construction process is not transparent and lacks sound statistical or conceptual principles. The selection of indicators and weights could be the subject of political dispute. May disguise serious failings in some dimensions and increase the difficulty of identifying proper remedial action if the construction process is not transparent. May lead to inappropriate policies if dimensions of performance that are difficult to measure are ignored.

Regardless of its limitations, opportunity mapping has become a common practice and an important tool for governmental and non-governmental organizations to assess the equitable distribution of opportunity among urban neighborhoods (Gastler and Sharkey,

2017). The interest in opportunity indices encouraged the development of a number of them over the past decade. Some of these indices are modeled to measure access to a specific opportunity (e.g., Park Serve cite), while others are developed to measure access to multiple aspects of opportunity (e.g., Opportunity Index, Opportunity 360 cite). Among various opportunity indices, the Child Opportunity Index (COI) is the only index focused on child population and has been calculated for 100 metropolitan areas, including Austin Metropolitan Area (diversitydatakids.org). Due to its focus on child population and data availability, COI will be used by this research to evaluate the neighborhood's access to an opportunity from the experts' view.

4.8 Neighborhood Social Organizational Structure and Children's Wellbeing

Neighborhood social, organizational structures refer to social processes and interactions that shape the relationships among people who live in the same neighborhood (Yen & Syme, 1999). The collective dimension of neighborhood community life has a considerable impact on children's wellbeing and outcomes (Sampson et al., 1999). In other words, social interactions and collective cohesion can enhance social connections, generate trust, and ultimately provide a healthy and safe environment for children.

Neighborhood environments start playing more significant roles in young children's lives, especially when children are old enough to go to elementary school. By being more regularly exposed to their neighborhood environment, children obtain some level of independence, which allows them to interact with other members of the local community, including other children and adults (Kohen et al., 2008).

A substantial body of interdisciplinary research discusses the importance of the neighborhood social environment in shaping children's outcomes (Kohen et al., 2008;

Bradley and Corwyn, 2002; Diez, 2001; Leventhal and Brooks-Gunn, 2000; Solon, Page, and Duncan, 2000; Sampson et al., 1999; Furstenberg and Hughes, 1997; Coulton and Pandey, 1992). These effects on children range from physical and mental health conditions to behavioral problems such as drug use, delinquency, teen pregnancy, and school achievement.

Neighborhoods, characterized by higher poverty and socio-physical disorder rates, tend to be more likely to have higher rates of child behavior problems (Caughy et al., 2013; Hanson, 2007). On the other hand, moving children to neighborhoods with higher socioeconomic status can improve children's mental health (Leventhal and Brooks-Gunn, 2000; Aneshensel and Sucoff, 1996), educational performance (Sirin, 2005), and health (Pickett and Pearl, 2001) outcomes. Overall, evidence has shown that neighborhood factors can significantly influence children's wellbeing and outcomes (Caughy et al., 2013).

4.9 Neighborhood Social Capital and Collective Efficacy for Children

Whether a neighborhood is socially supportive of children depends on neighborhood social capital and collective efficacy, two main neighborhood social environment constructs (Ichikawa, Fujiwara & Kawachi, 2017). Although these two concepts have much in common, Sampson et al. (1999) argued that the two concepts must be discussed separately. Over the years, social capital has been conceptualized from various perspectives. However, with respect to children, Sampson et al. (1999) defined neighborhood social capital as "the resource potential of personal and organizational network" that supports children's wellbeing by facilitating cooperation among community members. An example of neighborhood social capital is voluntary associations.

Collective efficacy refers to the level of social cohesion among neighbors and their willingness to contribute to the common good (Sampson, Raudenbush, and Earls, 1997). Collective efficacy for children has been defined as "a task-specific construct that relates to the shared expectations and mutual engagement by adults in active support and social control of children" (Sampson, Morenoff and Earls, 1999, p.635). A higher level of collective efficacy has been associated with better health outcomes, lower socioeconomic disadvantage, and lower crime rates (Sandel et al., 2016). Lower collective efficacy has been found associated with higher levels of mental health issues (Xue et al., 2005) and behavioral problems in children (Ingoldsby et al., 2006).

Social capital and collective efficacy are interrelated so that social capital can provide better ground for the generation or enhancement of collective efficacy in a neighborhood. However, the mere existence of social capital is not enough to generate collective efficacy in a neighborhood. Thus, although they are very similar concepts, they cannot be used interchangeably. Sampson et al. (1999) identify three neighborhood social organization dimensions that affect children's collective efficacy. The concept of childbearing first inspired them in Coleman (1988), and Sampson et al. introduce *intergenerational closure*, referring to whether children and adults within the neighborhood are linked to one another. For example, parents/guardians who know parents/guardians of their children's friends exchange information and advice and set norms to create a structure supporting children and facilitating control. Having many friends or acquaintances does not mean more support for children if that group of friends does not include the parents/guardians of their own children's friends.

The second dimension is represented by Coleman's idea of *reciprocated exchange*

(Sampson et al., 1999), which refers to the intensity of interaction among adults regarding their children within a community. Sometimes, adult interactions within a neighborhood are limited to knowing the other neighbors face-to-face or exchanging a few words. However, reciprocated exchange extends to more meaningful interactions that generate social support for parents/guardians and children.

The third dimension of social organization, *informal social control and mutual support for children*, takes a step further, requiring neighbors to trust one another to intervene on behalf of children within their community (Sampson et al., 1999). This trust level depends on shared values and beliefs among neighbors who actively engage in neighborhood social life. The notion of "active engagement" or neighbors acting as "agents" exercising *control* is the aspect that differentiates the concept of collective efficacy from social capita (Sampson et al., 1999).

4.10 Concentrated Disadvantage and its Impact on Collective Efficacy for Children

In the United States, due to the uneven distribution of physical and human capital, the neighborhood's socioeconomic characteristics have a strong association with geographic location and racial and ethnic composition (Sampson et al., 1999). The socioeconomic environment, composed of neighborhood residents' individual and collective social and economic characteristics, directly impacts the quantity and quality of resources available (Carroll-Scott et al., 2013).

Increasing evidence has shown strong associations between neighborhood socioeconomic status and long-term effects on children (Kohen et al., 2008). These associations have been reported for a range of outcomes from physical health (Dupéré et al., 2010; Singh, Siahpush & Kogan, 2010), behavioral problems (Klin et al., 2006;

Leventhal & Brooks-Gunn, 2000) to school achievements (Martens et al., 2014; Hanson et al., 2011). It has been well established in the literature that children who live in socioeconomically disadvantaged neighborhoods are more likely to have poorer physical and mental health (Marmot et al., 2008; Pebley and Sastry, 2004; Earls & Carlson, 2001). Also, living in disadvantaged neighborhoods negatively impacts children's school performances (Jones & Shen, 2014). On the other hand, moving to a neighborhood with a lower poverty rate seems to improve overall child wellbeing (Chetty, Hendren & Katz, 2016, Brooks-Gunn, Duncan & Aber, 1997).

The neighborhood socioeconomic status also influences neighborhood collective efficacy. Sampson and colleagues identified a group of factors, such as residential stability and concentrated disadvantage, as highly influential on collective efficacy variation (Sampson et al., 1997). In the sense of population loss or residential turnover, residential instability can cause gentrification, thus, weakened social ties and a lower chance of emergence of new social networks (Sampson et al., 1999). Neighborhoods that experienced residential mobility seem to be associated with higher child maltreatment rates (Coulton et al., 2007) and lower collective efficacy (Ma & Grogan-Kaylor, 2017).

With concentrated disadvantage, Sampson et al. (1997) refer to the geographic concentration of lower-income residents, particularly people of color s, immigrants, and female-headed families. With a shift in urban economic and political structures, concentrated disadvantage has become a bold characteristic of many urban areas in the USA, leaving communities of color more vulnerable to increasing poverty and racial/ethnic segregation (Parker, Stults & Rice, 2005), with a significant negative impact on children. Also, areas with a higher concentration of immigrants are likely to face

additional barriers to achieving collective efficacy due to cultural isolation and language barriers (Sampson, Morenoff, and Earls, 1999).

The concentration of affluence, in terms of income, education, and occupation, as a separate factor, seems to also positively influence the generation of social capital and collective efficacy for children. Positive associations have been found between higher socioeconomic status with better outcomes for children and youth in a community (Sampson, Morenoff, and Earls, 1999).

Another factor that can potentially influence communities' ability to generate collective efficacy for children is embedded in neighborhoods' impacts on surrounding neighborhoods (Sampson, Morenoff, and Earls, 1999). From the political economy point of view, the condition of resources in one neighborhood is related to resources in neighboring communities (Logan and Molotch, 2007), being also in line with Tobler's first law of Geography that "…near things are more related than distant things (1970). Caughy et al., 2013 argue that similar concepts can apply to children's behavior on other children living in neighboring areas.

Finally, other factors that can affect the emergence of collective efficacy and social capital for children in a neighborhood depend on adults' density compared to children and overall population density (Sampson, Morenoff, and Earls, 1999). The possibilities for generating support and social capital for children can be lower in neighborhoods with a relatively lower adult population. Also, lower population density increases the chances of limited social networks, thus lowering children's collective efficacy.

As discussed in this chapter, neighborhood child-friendliness is a factor of various

factors among which walkability, access to opportunity, and social organizational structure are three of the most important. Parental perceptions of the neighborhood environment play an important role (if not the most) in how and to what extent a child uses the neighborhood environment. Thus, it is crucial to examine the parental perceptions and compare them with how expert indices classify the neighborhood environment to understand the differences between local and expert knowledge leading to a more comprehensive view that could be leveraged to improve neighborhood planning.

5. RESEARCH METHODS

5.1 Site and Situation

As of 2019, Austin Chamber defines the Austin-Round Rock-San Marcos, also called Greater Austin or Austin Metropolitan Statistical Area (Austin MSA), including five counties: Bastrop, Caldwell, Hays, Travis, and Williamson (Figure 3). Due to its attraction as a destination for migrants, metro Austin's population exceeded 2.0 million in 2015, ranking first among the 50 largest U.S. metros based on net migration, with a 32.7% population increase and growth rate of 2.5% in 2018 (Austin Chamber, 2019).

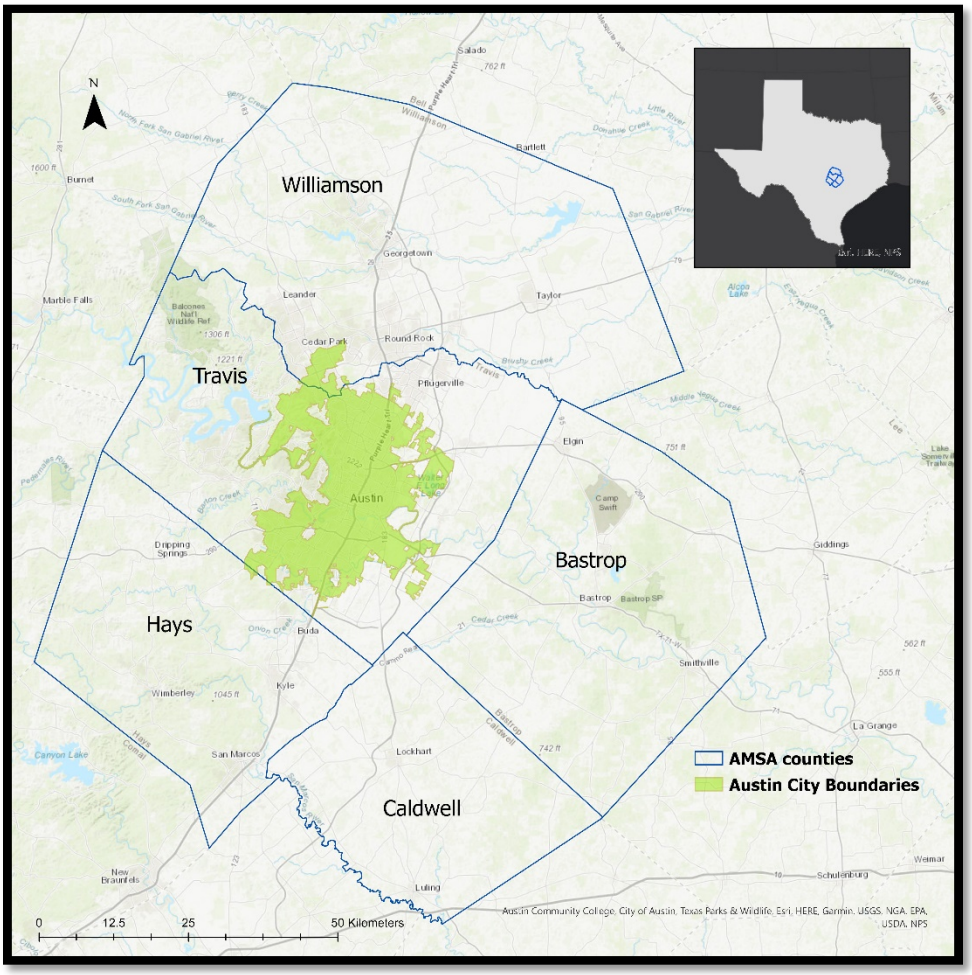

Figure 3. Study Area. Austin Metropolitan Statistical Area (AMSA), TX.

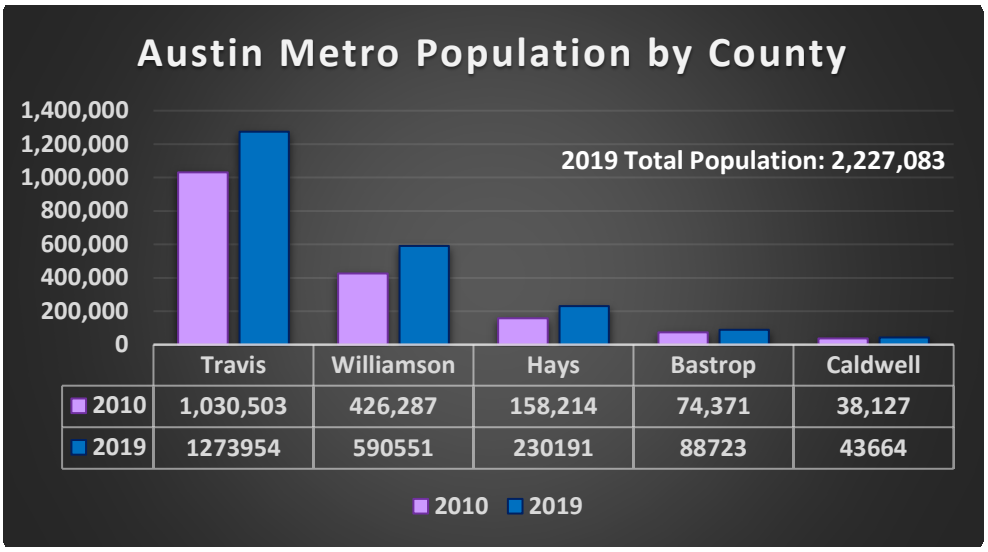

Figure 4. AMSA's population by county.

Figure 4 shows the estimated population in 2010 and 2019 for each of the five counties in the study area. In Travis County, Texas, Austin is Texas's capital, with an estimated population of 978,908 (Census 2019 Population Estimate). Austin, recognized as one of the most progressive and sustainable cities in the US, is experiencing extensive economic growth (Long, 2016), but at the same time is classified as one of the fastest gentrifying cities in the US with a long history of segregation and inequality (Busch, 2013).

Due to the growth of other ethnic and racial groups in recent years, the City's non-Hispanic (Anglo) share of the population has dropped below 50%; however, because of skyrocketing housing prices, the City's path toward greater ethnic and racial diversification is uncertain (City of Austin, 2019). Many areas in the central parts of the City have indeed become Whiter during the last few decades, including some areas in east-central Austin, historically inhabited by African American households, who have left east Austin for the suburbs and other parts of Austin. Figure 5 shows the distribution of African American populations across the study area in 2000 and 2020 (estimated). Comparing the two maps shows that several block groups have experienced a significant

loss in the number of African American residents, especially in Austin. In 2000, the African American population created 9.66% of the total population, while in 2020, the percentage is estimated to have been reduced to about 8.27% of the total (Simply Analytics, 2020).

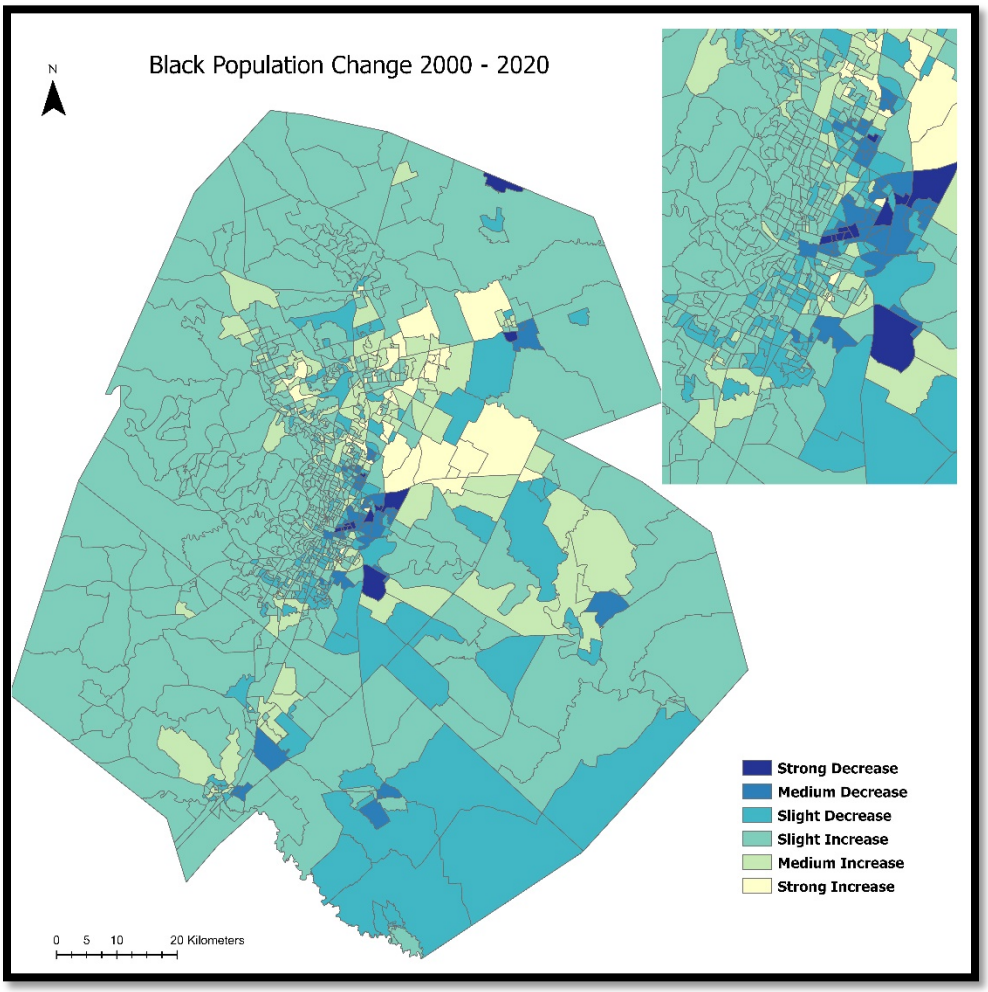

Figure 5. African American population change between 2000 and 2020 in AMSA.

In terms of the children's population, while the percentage of children (under 18) compared to the total population has been decreased, the absolute total number of children has been increased between 2000 and 2020 by 24.55% (Simply Analytics, 2020) within Greater Austin. In addition to these changes, Austin has been experiencing

extensive urban sprawl, which is still going on despite the dense residential development in Austin downtown. Due to all these characteristics that represent various dimensions of a progressive sustainable with a complex history of segregation and gentrification, Greater Austin offers an interesting landscape to study neighborhood child-friendliness.

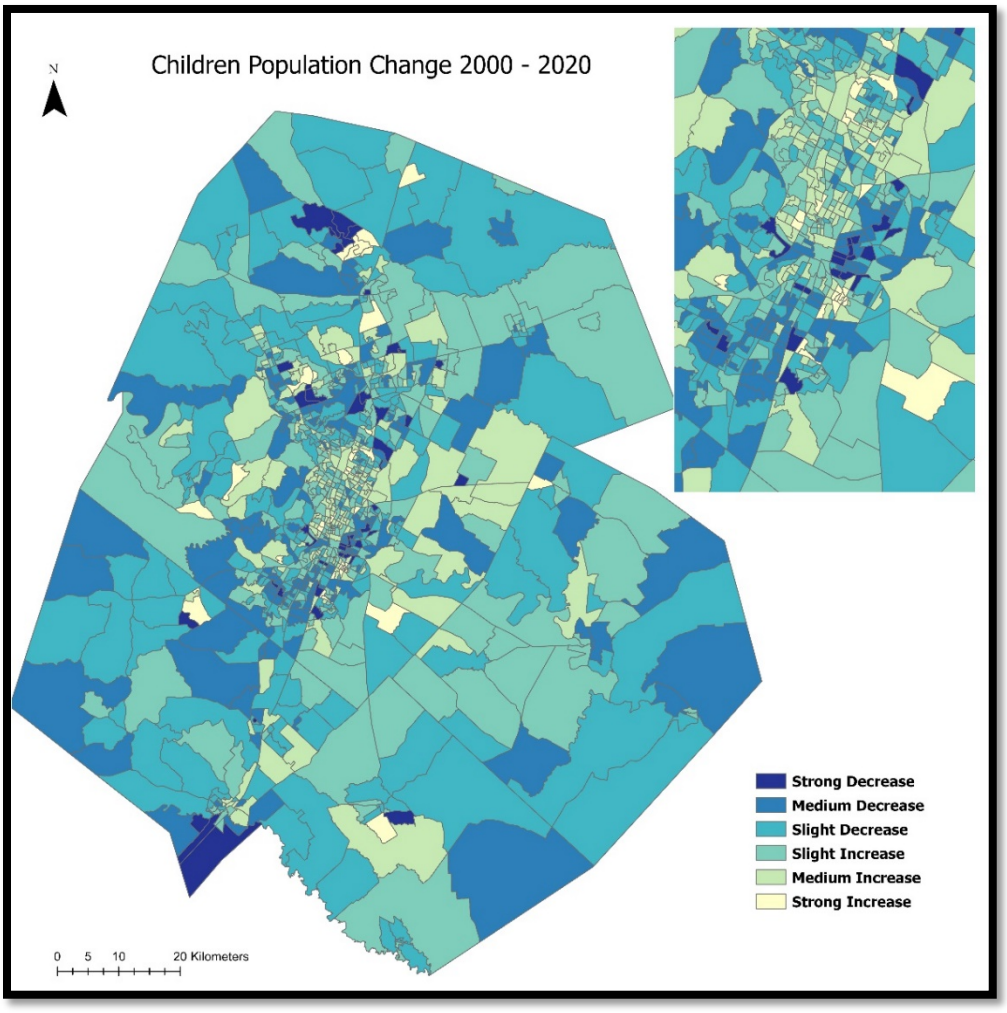

Figure 6. Child population change between 2000 and 2020 in AMSA.

5.2 Data

To examine the differences between expert knowledge and lay perceptions of the urban neighborhoods in the study area, this research uses various data, including secondary data collected from official sources, and primary data, collected by the researcher. Below is a list of data sources used for each research question.

Table 2. Summary of data sources.

Research Question	Data Source	Source	Collection Time
Expert Knowledge			
RQ1. What are the spatial characteristics of Austin's current walkability, opportunity, and collective efficacy indicators?	Walk Score Application Programming Interface (Walk Score API) Kirwan Institute's Child Opportunity Index Census Bureau's Socioeconomic data	https://www.walkscore.com/professional/api.php https://data.austintexas.gov/Building-and-Development/Kirwan-Institute-Opportunity-Map-Data/f4c7-5ivu https://www.census.gov/programs-surveys/geography.html	July 2020 August 2020 August 2020
Lay Perception			
RQ2. How do Austin parents of elementary-aged children perceive walkability, access to opportunity, and collective efficacy within their neighborhood?	Survey Interviews	Surveys and interviews were designed by the researcher. the survey was conducted online through the Qualtrics platform offered by Texas State University. Interviews were conducted online via Zoom offered by Texas State University.	March-May 2020 July-Nov. 2020
Difference between Expert Knowledge and Lay Perception			
RQ3. What are the quantitative and qualitative differences between urban planning indices (expert knowledge) and parents' perceptions and experiences raising children within the study area?	Walk Score API Kirwan Institute's Child Opportunity Index Census Bureau's Socioeconomic data Survey Interviews	RQ1 & 2 sources	N/A

4.3 Analysis

This research was designed to explore neighborhood child-friendliness based on expert knowledge and local knowledge to compare the differences between these two viewpoints finally. This section discusses the analysis employed to answer each research question.

4.3.1 Neighborhood Spatial Characteristics According to Expert Knowledge

This section describes the data and analysis used to answer the first research question: what are the spatial characteristics of Austin's current walkability, opportunity, and collective efficacy indicators?

Measure of Walkability: Walk Score

Launched in 2007, Walk Score was developed by professionals in urban planning, Public health, real estate, finance, and government, to measure walkability and accessibility to amenities (Walk Score, 2019). Multiple sources are used to gather data about a commute and access to amenities, including Google, Localeze, the U.S. Census, Open Street Maps, Education.com, and several transit agencies. Walk Score data is currently available in the United States, Canada, Australia, and New Zealand. The Walk Score algorithm examines hundreds of routes. It generates a walkability index based on the distance to 13 categories of amenities (e.g., schools, parks, book stores, libraries, recreation centers, movie theaters, supermarkets, coffee shops, bars, restaurants, clothing/music stores, pharmacies, hardware stores), weighted based on the distance to each amenity (Carr, Dunsiger, and Marcus, 2011).

The recent version of Walk Score (Street Smart Walk Score) uses a network-

based algorithm (as opposed to the previous version that used an algorithm based on Euclidian distances), which provides a more sophisticated method for identifying amenities and ranking locations based on their level of pedestrian friendliness (Nykiforuk et al., 2016; Frank et al., 2013; Walk Score, 2019). In addition to walking routes and distances to amenities, Walk Score includes information about road connectivity metrics (intersection and block length), and it gives a score based on each amenity category (Walk Score, 2019). The score ranges from 0 to 100, with 100 as the highest walkability rate or "walker's paradise" (Table 3). Amenities located within about 400 meters or a 5-min walk get the maximum score, and a distance decay logic is used to rank distant amenities, with 0 points given to amenities located within about 2.4 km or 30-min walk (Twardzik et al., 2019).

Table 3. Walk Score classifications.

Walk Score	Description
90–100	**Walker's Paradise** Daily errands do not require a car.
70–89	**Very Walkable** Most errands can be accomplished on foot.
50–69	**Somewhat Walkable** Some errands can be accomplished on foot.
25–49	**Car-Dependent** Most errands require a car.
0–24	**Very Car-Dependent** Almost all errands require a car.

Walk Score has been validated by multiple studies in various geographic locations

at different scales a few years after its launch (Carr et al., 2010, 2011) and later when its new version was introduced (Nykiforuk et al., 2016; Duncan et al., 2011). A few studies have shown a positive correlation between Walk Score and pedestrian infrastructure (e.g., street connectivity, highway density, speed limit, intersection density) and other factors such as population density, residential density, and access to public transportation (Duncan et al., 2011; Carr et al., 2010, 2011).

Walk Score was positively correlated to proximity to amenities such as parks, recreation centers, grocery stores, and other nearby destinations (Carr, 2011). Also, the Walk Score is positively associated with walking behavior in the United States (Hirsch et al., 2013; Brown et al., 2013) and Canada (Chudyk et al., 2015). For example, some studies found a positive association between Walk Score and increased walking and physical activity (Duncan et al., 2016; Cole et al., 2015; Brown et al., 2013) and decreased weight (Chiu et al., 2015). Other studies explored the associations between Walk Score and residents' perceptions (Bereitschaft, 2018; Towne et al., 2016).

Collecting Walk Score Data and Analysis

The Walk Score website provides walkability information only for individual addresses. However, in this research, Walk Scores need to be obtained for each block group in Austin MSA. To do so, ArcGIS Pro 2.1 was used to create a list of the mean centers of U.S. Census block groups weighted by 2010 block-level population (Knight et al., 2018). Using the population data helps obtain a better estimate of the mean center that reflects the population distribution.

The calculated mean center points represent the latitude and longitude. As

mentioned above, the Walk Score website offers a restricted use of only addresses. Therefore, this research used the Walk Score API to obtain each block group's mean center scores. A script of R language (http://r-project.org) from the package Walk Score API (Whalen, 2015) was used through the Walk Score API to capture the required data by entering the geographic coordinates of the mean centers of the block groups.
The Walk Score algorithm uses a distance decay function to measure walking paths from an address point to nearby amenities (Knight et al., 2018). As a result, the closest and farthest destinations, respectively 0.25 and 1.5 miles, receive the highest and lowest walk scores in respectively. The scores will be visualized on a scale of 0 to 100, with 0 indicating the lowest and 100 the highest suitability for walking to nearby amenities (Walk Score, 2014).

The data collected from the Walk Score API was obtained as an Excel sheet that contained the Walk Scores data in the numeric and text (description of the number) formats. In ArcGIS Pro 2.6.1, the block group identifiers were used to join the Walk Score data to Austin's shapefile at the block group scale.

Measure of Opportunity: Child Opportunity Index (COI)

The Institute for Child creates the COI, Youth and Family Policy, Brandis University (diversitydatakids.org), and the Kirwan Institute for the Study of Race and Ethnicity to measure relative opportunity focused on children. COI was initially created in 2010 for census tracts in the 100 largest metro areas. In 2015, the Institute for Child, Youth and Family Policy, Brandis University (diversitydatakids.org, 2020) introduced an updated version, COI 2.0, showing child opportunity scores for census tracts in 50 U.S.

states and Washington, D.C. This index defines child opportunity in terms of neighborhood-based indicators that can influence a child's health and development through three domains of neighborhood opportunity: education, health, and environment, social and economic.

The COI combines 29 neighborhood indicators (Table 4) to create a composite measure for the 100 largest metropolitan areas in the U.S., including Austin MSA in Texas. The process used to create the index is, to some extent, standardized (Knaap, 2017). The COI includes variables measured based on different scales, such as counts and percentages. To create the index, the raw values of each variable were standardized based on the z-score transformation using the formula below:

$$Z_{ijt} = (x_{ijt} - m_{j,t=2010}) / sd_{j,t=2010}$$

In the next step, variables were combined into education, health, and environment, social and economic. When combining the variables into domains, they were weighted based on how strongly they predicted health and socioeconomic outcomes (diversitydatakids.org, 2020). All variables were obtained from the decennial census (2010) at the census tract scale. Table 4 shows the variables used to create each domain and the overall composite index.

Despite the straightforward process, the COI's methodology involves a series of subjective decisions and mathematical skills that could potentially influence the results (Knaap, 2017). For example, due to limited data, some important factors, including violence and crime, can impact child well-being and are not included in this index (Acevedo-Garcia et al., 2014). Also, to bring the variables to a common range, the index indicators are standardized before being combined into a composite index. The overall

index is categorized based on quintiles as very high, high, moderate, low, very low, with very high representing the top 20% and very low representing the lowest scoring 20% among census tracts within a metropolitan area (Acevedo-Garcia et al., 2014). As discussed in the previous paragraphs, the quantile classification can be misleading and not a correct representation of reality.

Table 4. Indicators Comprising the Overall Child Opportunity Index. Adopted from Kirwan Institute, 2019.

Education		
Subdomain	Indicator	Definition
Early childhood education (ECE)	ECE centers	Number of ECE centers within a 5-mile radius
	High-quality ECE centers	Number of NAEYC accredited centers within a 5-mile radius
	ECE enrollment	Percent 3- and 4-year-olds enrolled in nursery school, preschool, or kindergarten
Elementary education	Third-grade reading proficiency	Percent third graders scoring proficient on standardized reading tests converted to NAEP scale score points
	Third-grade math proficiency	Percent third graders scoring proficient on standardized math tests converted to NAEP scale score points
Secondary and postsecondary education	High school graduation rate	Percent ninth graders graduating from high school on time
	Advanced Placement (AP) course enrollment	The ratio of students enrolled in at least one AP course to the number of 11th and 12th graders
	College enrollment in nearby institutions	Percent 18-24 year-olds enrolled in college within a 25-mile radius
Educational and social resources	School poverty	Percent students in elementary schools eligible for free or reduced-price lunches, reversed
	Teacher experience	Percent teachers in their first and second year reversed
	Adult educational attainment	Percent adults ages 25 and over with a college degree or higher
Health & Environment		

Healthy environments	Access to healthy food	Percent households without a car located further than a half-mile from the nearest supermarket reversed
	Access to green space	Percent impenetrable surface areas such as rooftops, roads, or parking lots, reversed
	Walkability	EPA Walkability Index
	Housing vacancy rate	Percent housing units that are vacant reversed
Toxic exposures	Hazardous waste dumpsites	The average number of Superfund sites within a 2-mile radius, reversed
	Industrial pollutants in the air, water, or soil	Index of toxic chemicals released by industrial facilities, reversed
	Airborne microparticles	Mean estimated microparticle (PM2.5) concentration, reversed
	Ozone concentration	Mean estimated 8-hour average ozone concentration, reversed
	Extreme heat exposure	Summer days with maximum temperature above 90F reversed
Health resources	Health insurance coverage	Percent individuals ages 0-64 with health insurance coverage
Social & Economic		
Economic opportunities	Employment rate	Percent adults ages 25-54 who are employed
	Commute duration	Percent workers commuting more than one hour one way, reversed
Economic and social resources	Poverty rate*	Percent individuals living in households with incomes below 100% of the federal poverty threshold reversed
	Public assistance rate*	Percent households receiving cash public assistance or Food Stamps/Supplemental Nutrition Assistance Program reversed
	Homeownership rate*	Percent owner-occupied housing units
	High-skill employment*	Percent individuals ages 16 and over employed in management, business, financial, computer, engineering, science, education, legal, community service, health care practitioner, health technology, arts, and media occupations
	Median household income*	The median income of all households
	Single-headed households	Percent family households that are single-parent headed reversed

**These five indicators are combined into an economic resource index.*

Data and Analysis

The COI data (2015) was collected through the Austin Open Data portal (https://data.austintexas.gov/). This dataset comes in the format of a shapefile and includes information at the block group scale for the five counties of Austin MSA, including Bastrop, Caldwell, Hays, Travis, and Williamson.

The dataset provides individual indices in three categories: education, health and environment, and economic and social. It also provides an overall index of opportunity classified on a scale of 1 to 5, with 1 indicating very low access to opportunity and five very high access to opportunity. Arc GIS Pro, version 2.6.3, was used to visualize and analyze the opportunity landscape according to COI for Austin MSA.

Measuring Neighborhood Potential to Generate Collective Efficacy for Children

Neighborhood potential to generate collective efficacy is embedded in a neighborhood's social structure shaped by the system's political economy that classifies neighborhoods based on distinct socioeconomic characteristics (Sampson et al., 1997). Regarding child population, it has been found that the socioeconomic profile is a strong predictor of child physical and mental wellbeing (World Health Organization, 2008). In urban areas with an intense history of segregation and racial disparity, the interplay between poverty and racial isolation has led to the creation of clusters of neighborhoods with higher socioeconomic disadvantage levels (Sampson et al., 2002). A similar experience has marked the urban areas in Central Texas. Austin's city has still been struggling with the adverse effects of segregation and deprivation that are still felt among the Latino and African American residents (Bush, 2013).

To understand the spatial distribution of socioeconomic disadvantage and racial disparity, this section will use the *concentrated disadvantage* index proposed by Sampson and colleagues in their highly cited study of 1997 to examine the neighborhoods' socioeconomic structure in the study area. A neighborhood with a higher concentration of socioeconomic disadvantage seems to lack a socially cohesive environment required for children's healthy development (Sampson et al., 1999). Thus, higher concentrated disadvantage seems to be associated with lower chances for a neighborhood to provide collective efficacy for children.

This composite measure of concentrated disadvantage is defined by percent African American population, percent children, percent below the poverty line, percent unemployed, percent on public assistance, and percent female-headed families. Other factors, including percent Latino population and percent foreign-born, are also considered evidence that urban areas with a higher immigrant population are more socioeconomically disadvantaged. Also, Sampson et al. (1997) included percent residents who lived in the same house as 1985 and percent owner-occupied house to represent residential stability.

Data and Analysis

Following Sampson et al. (1997), ten variables were obtained from the U.S. Census Bureau to reflect neighborhood socioeconomic characteristics concerning the poverty (population in poverty, a household with public assistance income or food stamps/SNAP), unemployment (percent unemployed), age (under 18), immigration (foreign-born including citizens and non-citizens), family structure (female-headed household) distribution of racial and ethnic minorities (African American and Hispanic

population). Instead of residential stability, this dissertation captured the aspect of residential instability using the two variables: renter-occupied and household moved in 2010 or later. Residential instability seems a more relevant aspect of the current study area as being one of the nation's fastest gentrifying urban areas and an attraction for specialized migrants.

To replicate the index based on Sampson et al. (1997), factor analysis is used to examine the census variables for any underlying structures that further explain the study area's block groups' socioeconomic profile. Factor analysis is a reductionist statistical technique that explains a larger set of variables in terms of a few factors (Child, 2006). Interpreting how variables are grouped to create the factors facilitates understanding complex concepts represented by the observed variables. Factor analysis simplifies replicating the variables at other spatial scales; thus, data complications become more efficient (Cutter, Boruff, & Shirly, 2003).

JMP Pro 15 software, made available by Texas State University, was used to conduct factor analysis. Before conducting factor analysis, we confirmed that Bartlett's test for sphericity was significant (Chi-Square = 90311.8, (Prob > ChiSq) < .0001). Another Bartlett's test of significance confirmed that the number of factors was sufficient for factor analysis (Chi-Square = 8372.539, Prob > ChiSq < .0001).

Concentrated Disadvantage Index

In the absence of justifiable criteria, an additive model was used to create the composite concentrated disadvantage index (CDI) for each block group. Thus, the composite index was created by adding up factors 1, 2, and 3. The additive model was used to avoid making any prior assumption about each factor's relevance in the overall

index (Cutter et al., 2003). In this way, all factors have an equal contribution to the overall index. The scores were added to the original block group shapefile and mapped based on standard deviations from the mean to visualize CDI distribution.

5.3.2 Neighborhood Spatial Characteristics According to Local Knowledge

This section explains the data and analysis used to answer the second research question: How do Austin parents of elementary-aged children perceive walkability, access to opportunity, and collective efficacy within their neighborhood?

Methods

In this study, local knowledge is defined as the knowledge and perception of parents of elementary school-aged children regarding how child friendly they consider their neighborhood in terms of walkability, access to opportunity, and social, organizational environment. Arrangements for data collection for this part of the research started a few months before the Covid-19 pandemic. After obtaining the IRB approval (#6726) on September 17, 2019, a meeting with the Austin Council of Parent-Teacher Associations (ACPTA) was organized to explain this research's goals and eventually ask for their support during the data collection process. Per the request of ACPTA, I participated in a parent outreach event called “Back the Future” to introduce this project to participating parents and other 100+ local organizations. Participation in this event helped the researcher to test the survey instrument through a pilot data collection. This was also an important networking opportunity with other local organizations to get their support in distributing the survey to parents in Austin, TX.

The feedback collected at this event was used to improve the online survey shared with ACPTA by email using an electronic flyer. The ACPTA shared the survey with all

its members in their monthly newsletter announcements. In January-February 2020, with the ACPTA's support, the researcher contacted each elementary school-level Parent Teacher Association (PTA) in Austin, Texas, with a request to participate in one or some of their meetings to present this research and encourage parents' participations. A letter was mailed to 84 PTAs in public schools with an official location/address. In late February, the researcher attended a school-specific PTA meeting. At the meeting, the researcher made a brief announcement and handed out single-page information sheets directing parents to the online survey.

In March 2020, due to the restrictions imposed by the COVID-19 pandemic, the process of data collection had also been slowed down until it completely stopped in April 2020. Seventy-nine surveys were collected in total through the Qualtrics online platform supported by Texas State University. After no surveys came in for a few weeks, an alternative data collection plan had to be considered. The next sections include details about the survey instrument and data collection logistics under the altered circumstances.

Survey Instrument

The survey instrument was designed to capture parental knowledge and perceptions of neighborhood child-friendliness regarding walkability, access to opportunity, and social environment. The initial version of the survey was available online and in paper format (through mail or face-to-face) and was supposed to be administered through PTAs and other local organizations. With Covid-19 restrictions in effect, an amendment was submitted in the IRB application to explain the changes in the data collection process under COVID-19 guidelines and the reasons for which these changes had to happen.

Continuing the data collection under the original plan, while people were going through such emotionally, socially, and economically stressful circumstances, seemed completely impossible. Thus, under the new plan, the Qualtrics company was commissioned to conduct the collection of surveys. In this way, the surveys were collected systematically, securing the collected data's high quality and validity. After a few meetings with Qualtrics data collection advisers, a contract was signed to use the Qualtrics data collection services to administer the survey. To proceed, a Qualtrics Research Specialist (QRS) reviewed the survey and suggested a few changes in the question formats and compensation process. Below is a summary of the main changes:

- The format of a few questions changed from open-ended to multiple-choice.
- The study area had to be changed. According to the QRS Project Manager (PM) assigned to this research, the original study area, the city of Austin, was not extended enough to collect 400 surveys. Also, each survey's cost could significantly get high (with no guarantee of collecting 400 surveys) if the researcher decided to keep Austin as the study are. The PM suggested extending the study area to Austin Designated Market Area (ADMA).
- The compensation process changed. According to the pre-Covid-19 plan, participants could choose to provide contact information to be included in a drawing for one of the 100 available $20 Visa gift cards. However, according to the Qualtrics Research services (QRS) rules, no personal information, including contact information, could be collected. Thus, the researcher repurposed the fellowship money to pay for QRS $8 per person that included the compensation. In this way, participants were compensated for the amount they agreed upon before entering the survey.

Participant Recruitment and Compensation

Qualtrics uses a system that recruits participants from various sources, including targeted email lists, customer loyalty web portals, gaming sites, permission-based networks, social media, etc. Participants may be airline customers who decide to take the survey in reward for SkyMiles, retail customers who opt-in to receive points, or general consumers who take the survey for gift cards, etc.

Participants' identities, addresses, and dates of birth are usually validated via third-party verification measures. Also, participants are subject to additional quality control measures such as phone calls to the participant's business, LinkedIn matching, and other third-party verification methods. Participants receive an email with a hyperlink that takes them to the survey and mentions the compensation/incentive offered.

Survey Lifecycle

The survey was launched using the Qualtrics platform and data collection services. Survey lunch occurred in three phases. In the first phase, "pre-launch," a Qualtrics data collection adviser reviewed the survey and set it up within the online platform. In the second stage, the soft launch, a small fraction of total data (about 20 surveys) was collected. This stage took about three days. The Qualtrics adviser and I checked that the screener questions and quotas worked correctly. The third phase was the full lunch. In this phase, the Qualtrics team provided updates on progress and feasibility every few days. Overall, the data collection took about a month, and 407 surveys were gathered in total.

Survey Questions

The survey instrument used a combination of multiple-choice, Likert-scale, and open-ended questions to understand how the neighborhood environment is experienced and used by children through their parents' eyes. The questions are designed to collect parental knowledge and perceptions in three areas of walkability, access to opportunity, and social environment in relation to their children as users of the neighborhood environment.

The survey starts with three screeners, disqualifying the participant from finishing the survey if failed by a participant. These three questions ask for the participant's zip code, the number of children, and several elementary school children. If the responses to these three questions fall within this research criterion (Austin DMA zip code, at least one child, and at least one child in the elementary school), the respondent will be allowed to answer the rest of the questions.

After the screeners, the survey includes three questions regarding the estimated distance (in miles) from respondent's residence to their child/children's school, distance (in minutes) that their child/children is/are allowed to travel on their own, and with friends. Also, the respondents are asked about their child/children's mode of transportation to school and whether they commute on their own or are accompanied by an adult or friends.

To get a close idea about the location of the respondent's residence while respecting their privacy, the survey asks them to provide a street intersection near their residence (for example, street A and street B). Also, they are asked about the duration they have lived in Austin DMA and their current neighborhood.

In addition to a few standard sociodemographic questions (age, gender, marital status, income, and education), the participants are asked about their neighborhood's walkability conditions, access to opportunity, and social environment. The survey includes five Likert-scale questions for each of the latter topics (15 in total). Finally, the survey includes three open-ended questions for participants to add any additional recommendations or whether they would like to see any features added or removed to make their neighborhoods more child friendly.

Analysis of Survey Responses

The survey instrument was designed to include a set of Likert-scale questions in addition to a few open-ended questions. The Likert-scale questions were grouped to collect information regarding parents' perceptions of the three themes of neighborhood walkability, access to opportunity, and social environment. This allows for quantitative comparison of expert and local knowledge and ultimately visualization of the difference. The first step of the analysis was exploratory and summarized the descriptive statistics of the respondent's characteristics. In the next step, Likert-style responses, ranging from "strongly disagree" to "strongly disagree," were recoded into numbers, where "strongly disagree" gets a value of 1 (showing the lack of walkability, opportunity, and collective efficacy), "disagree" gets a value of 2, "neutral" gets a value of 3, "agree" gets a value of 4, "strongly agree" gets a value of 5 (indicating the highest level of walkability, opportunity, and collective efficacy." In the case of answers "not sure" or "my neighborhood does not have sidewalks/trees" a 0 was assigned.

Five questions were considered for each topic (walkability, access to opportunity, social environment). The five questions' scores were summed up to create a score for

each category. Due to the insufficient number of surveys in each block group, it was impossible to calculate an overall score for each block group based on the parent's perception. Therefore, instead of creating a relative importance index for each block group, the scores are considered at the individual survey level scale.

Interview

This study uses a semi-structured face-to-face interview to collect more in-depth information regarding parents' knowledge and perception of their neighborhoods' child-friendliness. The interviews were planned to be in-person, but they had to be conducted virtually via the Zoom platform, provided by Texas State University, due to the pandemic restrictions. The participants were selected among those who took the first round of surveys before the pandemic because the surveys administered by Qualtrics collection services did not allow the gathering of personal information, including email addresses. Out of 79 surveys collected by the researcher, 27 provided their email addresses to participate in the follow-up interview. However, only seven who responded to the invitation email participated in the interview. The email invitation was sent four times between June to November 2020.

Analysis of the Interview Responses

As mentioned above, the surveys collected through Qualtrics did not contain the participants' names and email information due to the company's policy. Therefore, the interview participants had to be selected among those who took the survey before Covid-19 (the first version of the survey). Out of 27 participants who voluntarily provided their names and email addresses, only seven responded to the interview invitation. The

invitation was sent to them four times between July and November 2020. As Austin, TX was originally the study area for this dissertation, the first round of surveys targeted only parents who live in Austin. Therefore, all seven parents who participated in the follow-up interview live in Austin, Texas.

Due to confidentiality, the participants' real names are not used, and random names were selected. The interviewees were asked to expand their answers to the survey questions regarding their neighborhood's walkability, opportunity, and social environment (collective efficacy) in relation to their children as the environment's users. Each interview took approximately 20 to 30 minutes, and all of them occurred on Zoom. Six of the participants out of seven activated their camera, so most of the interviews happened virtually face-to-face. The interviews were recorded transcribed by Zoom as well as another online platform (Temi.com). Afterward, they were reviewed and adjusted by the researcher by re-listening to the recordings. MaxQDA 2020 (student version) was used to code, analyze and visualize the results.

5.3.3 Difference between Expert and Local Knowledge

To compare the indices and calculate the difference between an expert and local index, all of the indices were normalized on the scale of 1 to 10 using the following formula:

$$y = 1 + (x-A) * (10-1) / (B-A)$$

A is the minimum and B is the maximum, and x is any number in each index category. Thus, if x = A (minimum of the original scale), the result would be y = 1 (minimum of the new scale), and if x = B (maximum of the original scale), y would be 10 (maximum of the new scale). Finally, the local score was subtracted from the expert score to calculate the difference between the expert view and local perception.

A further step was taken to examine whether there were any geographic patterns in the distribution of difference scores. In specific, this step examined whether there were any clusters of negative and positive scores among the difference scores. This analysis was done using the Optimized Hotspot Analysis (OHA) tool in ArcPro 2.7. OHA is a popular analytical technique to look for clusters in a data set. The original local statistics developed explicitly for the exploration of data sets are the Getis-Ord Gi and G* i statistics, which assess the degree to which high or low values in a data set are spatially clustered (Douglas et al., 2019; O'Sullivan & Unwin, 2010). OHA represents the resulting clusters based on the degree they are statistically significant as a hot or cold spot. Hot spots or cold spots are identified based on whether a high or low value is surrounded by other high or low values to create a cluster of high or low values. Like many other statistical methods, the results are reliable within a specific range of numbers for features set to a minimum of 30.

5.4 Results

This section presents the results for each research question. The first research question examines walkability, access to opportunity, and collective efficacy in Austin MSA neighborhoods, based on expert indices, Walk Score, Child Opportunity Index, and Concentrated Disadvantage index. The second research question examines the neighborhood environment's same aspects from the local view (parental perception). The third research question examines the difference between expert and local results based on each aspect and overall.

5.4.1 Neighborhood Child-Friendliness According to Expert Knowledge

The following sections present the results for the first research question: What are the spatial characteristics of Austin's current walkability, opportunity, and collective efficacy indicators?

Mapping Walk Scores

The Walk Score index was used to show the study area's walkability according to one of the most widely used walkability indices (representing the expert view). Figure 7 shows the spatial distribution of Walk Scores across Austin MSA. Other than some block groups in Austin and San Marcos downtowns, the rest of the study area is mostly classified as very car-dependent or car-dependent. Only 93 out of 960 block groups are very walkable or walker's paradise, 141 block groups are somewhat walkable, and 726 were very car-dependent. The Walk Score was not available for four block groups in the study area shown by the color gray on the map.

To better understand the distribution of child population (6-11 Years), Figure 8 shows an overlay of child population through the study area. It is visually clear that most of the children live in neighborhoods classified as very car-dependent. Only 5,637 children out of 181,060, representing 3.1% of the total, live in very walkable neighborhoods or walker's paradise (mostly located in Austin's downtown area).

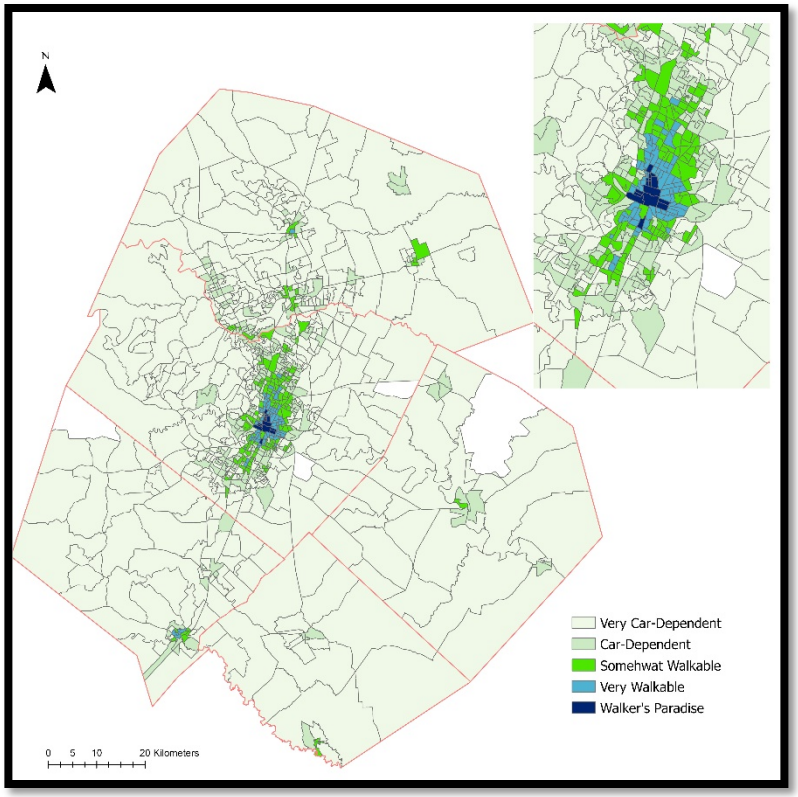

Figure 7. Walkability in AMSA (Walk Score).

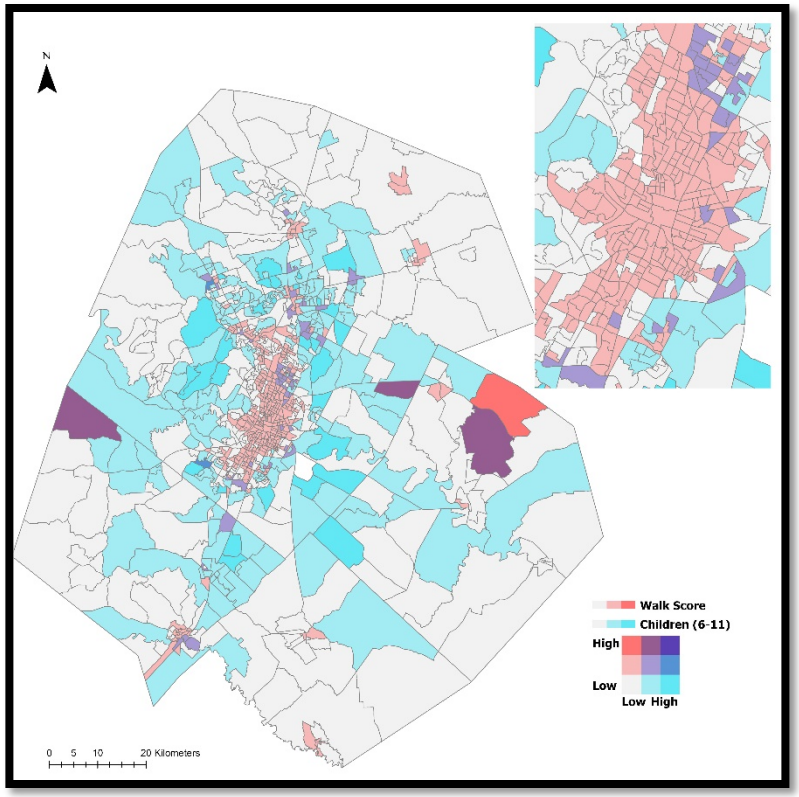

Figure 8. Walkability in AMSA with child population (6-11).

Mapping Child Opportunity Index

The opportunity results were mapped based on individual indices (education, housing, and environment, economic and mobility) and the overall child opportunity scores. The economic and mobility indicator (Figure 9) shows that most of the economic wealth is clustered in the central and western block groups in Travis County, while most of the remaining block groups, especially on the Eastern side) in the study area seems to offer very low economic and mobility opportunities. The distribution of economic and mobility opportunities does not seem to be polarized in Williamson, Hays, Bastrop, and Caldwell counties. While Travis county shows a clear division between East and West. The mean score in Bastrop and Caldwell counties is consistently moderate to low among all block groups.

On the same lines, most educational opportunities are prevalent on the west side of the study area in Travis, Williamson, and Hays counties (Figure 10, left). However, all block groups in Bastrop and Caldwell counties are assigned to the low and very low categories. The health and environment indicator (Figure 10, right) shows the prominence of very high and high block groups in the Western side of the study area, mostly in Travis County. The East of the study area, however, shows very low and low scores in Travis County. Also, most block groups have been assigned a moderate or lower score in Bastrop and Caldwell counties. Austin downtown shows many block groups with moderate, low, or very low scores. This is in line with this area being an economic hub with a high concentration of businesses and higher pollution.

The overall child opportunity index shows an unequal distribution of opportunity between the West and East of the study area, especially in Travis County. Overall, 386

out of 964 (40%) are assigned a high or very high score, with few being in the East. Most of the block groups with very high opportunity index, located in the western parts of Interstate 35, are occupied by mostly white and more affluent residents. This is in line with Austin's history of segregation. On the other hand, the eastern block groups contain a larger percentage of the African American and Hispanic population. Only a few block groups show very high or high opportunity in the study area's eastern side. Also, most of the areas assigned with a low or a very low opportunity score are located in the eastern side of Austin MSA (east Austin, Bastrop, and Caldwell counties). These block groups contain 39.1% of the child population (6-11 years), out of which 21.4% live in areas with very low access to opportunity (Figure 11).

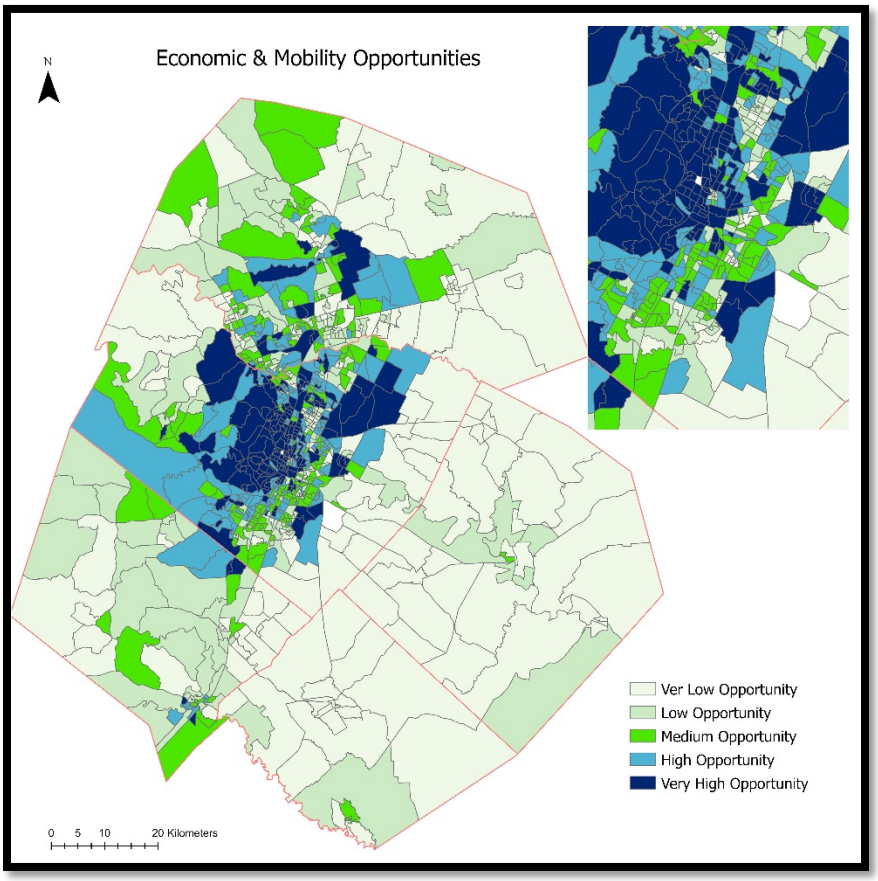

Figure 9. Child Opportunity Index (COI) for economic & mobility in AMSA.

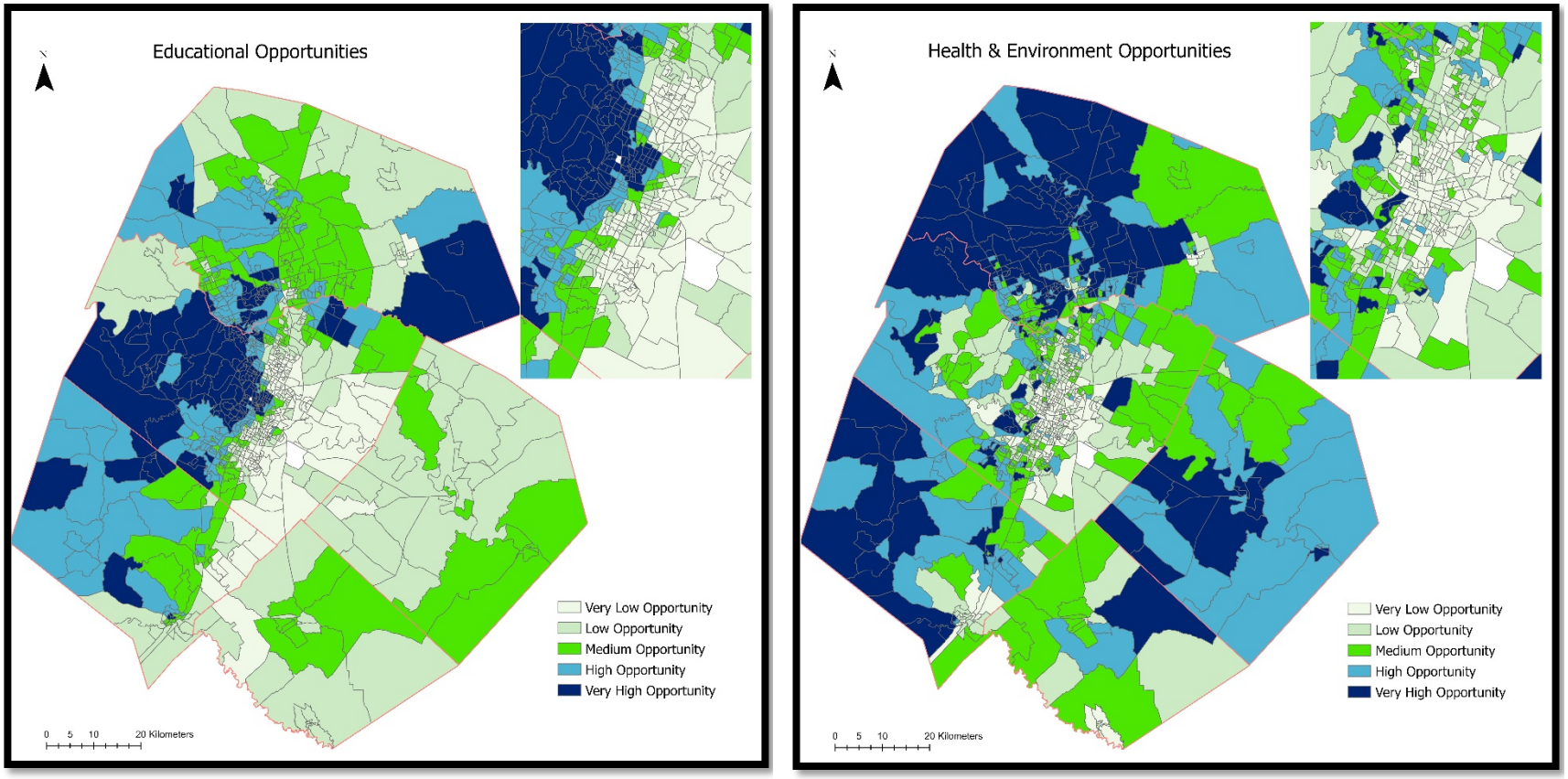

Figure 10. Child Opportunity Index (COI) for education and health in AMSA. COI education is shown on the left, and COI health and environment is shown on the right.

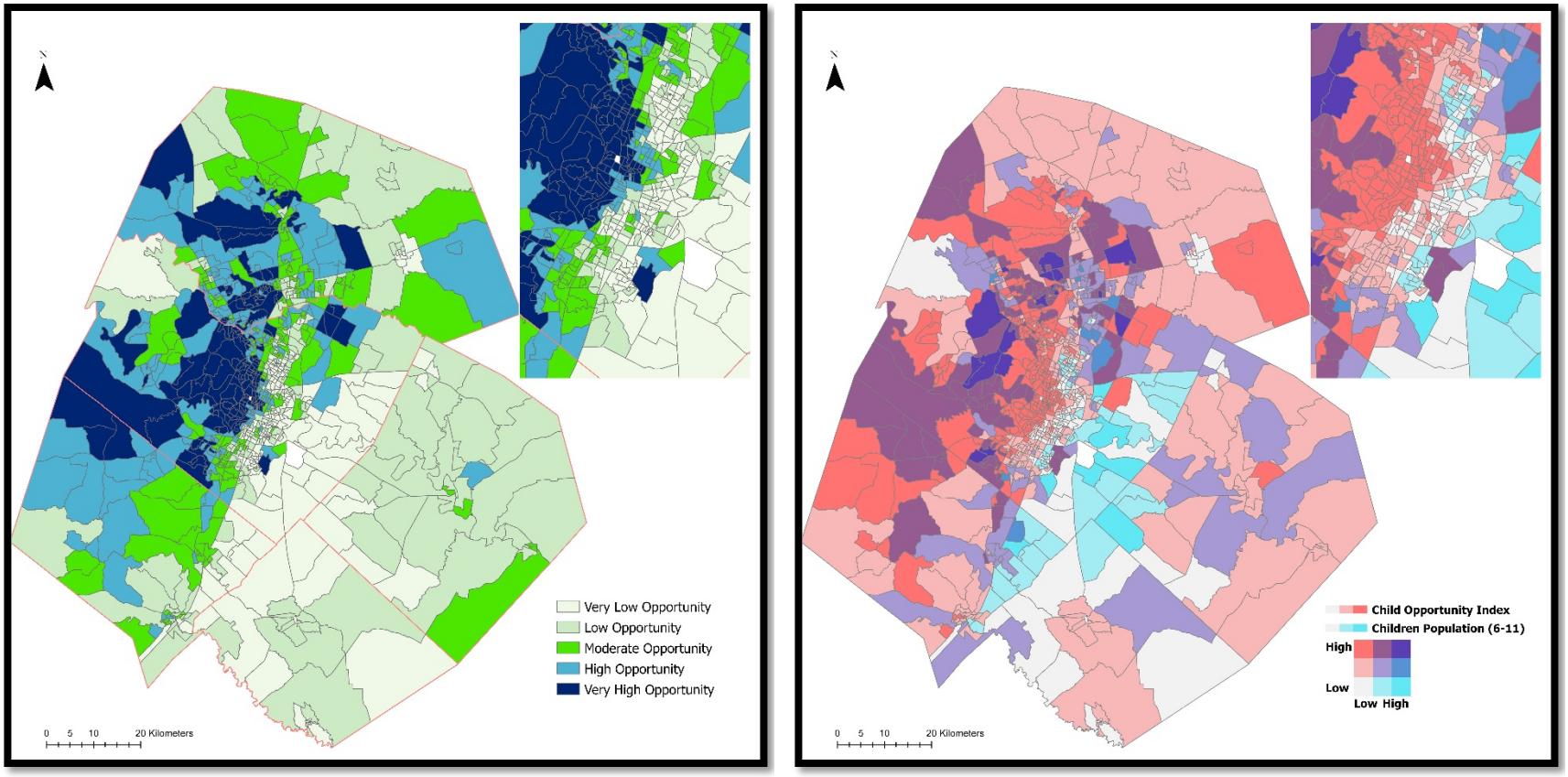

Figure 11. Overall Child Opportunity Index (COI) in AMSA. The figure on the right shows the overall COI index with child population in AMSA.

Mapping Concentrated Disadvantage Index

With an eigenvalue of 1.24, a total of 3 composite factors was produced, which explained 70.31 percent of the variance among all block groups (Table 5). These factors differentiate the block groups (neighborhoods) according to their socioeconomic profiles in terms of concentrated disadvantage. Out of ten variables, eight variables were loaded with a loading score of more than 0.5. Only two factors had a lower loading score: percent foreign-born and percent unemployed. The three composite factors were interpreted and titled based on a common theme inspired by the variables loaded on each factor. Each of the three factors is described in the following sections.

Concentrated Poverty

Consistent with the literature, the poverty-related variables are grouped and loaded on factor one (Table 5). With variables including the percentage of the Hispanic population (0.86), household on public assistance income or food stamps (0.73), the population in poverty (0.62), and child population (0.53), the predominant theme revolves around concentrated poverty. The concentrated poverty factor explains 24.95 of the variation among the block groups. This combination of variables leads to an interpretation that Hispanic families with a greater number of children live in neighborhoods with higher poverty concentration. Percent foreign-born and percent unemployed also loaded on factor one with weaker loading scores of, respectively, 0.47 and 0.33 indicating a weaker relationship with other factors loaded on factor one. Such scores do not seem sufficient to imply that foreign-born residents and unemployed residents live in neighborhoods with higher poverty rates. Therefore, these variables were not included in Table 5.

To represent the concentrated poverty dimension, a factor score was calculated that weighted each variable by its factor loading. The scores were then mapped, showing factor one scores for each block group based on the standard deviation (Figure 12). The block groups shown with the color green and yellow on the map are the areas with a higher concentration of poverty. Most of these block groups are located on the east side of Austin, TX. However, the areas on the western side of the study area, including Austin, show a lower level of concentrated poverty. Again, this is in line with Austin's history of segregation, and racial inequality as most of the Hispanic and African American population live on the east side of the city.

Table 5. Rotated factor pattern (Loadings > 0.55) in 1117 AMSA block groups.

Variable	Factor Loading
Concentrated Poverty	
Hispanic	0.86
Below poverty line	0.62
Household with Public Assistance Income or Food Stamps/SNAP	0.73
Child population	0.53
Residential Instability	
Moved in 2010 or later	0.88
Renter-occupied	0.97
Minority Concentration	
Female-headed families	0.57
African American	0.79

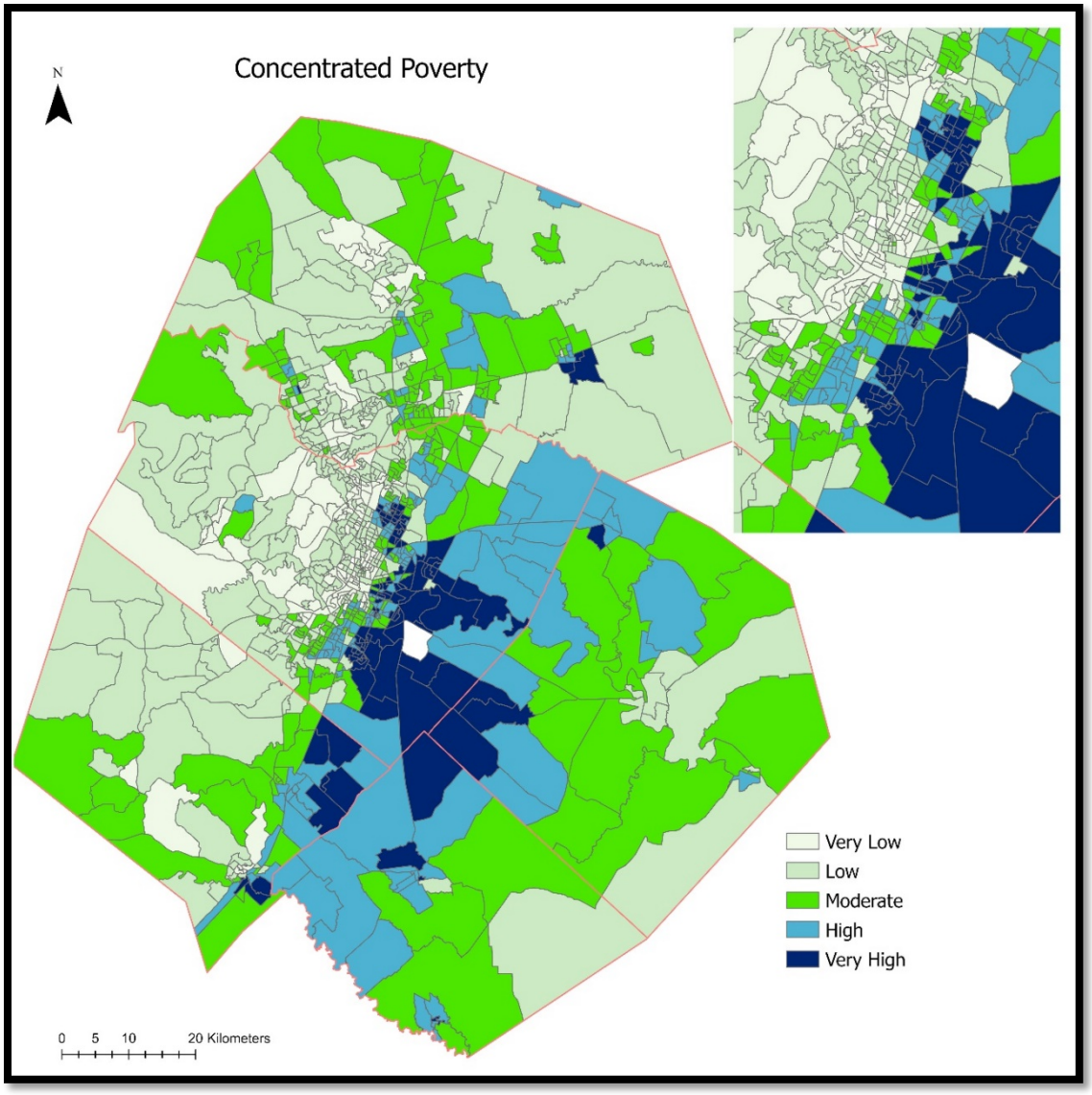

Figure 12. Concentrate Poverty in AMSA.

Residential Instability

The second dimension, represented by factor two, captures residential instability in the study area. This dimension includes two variables: the percentage of renter-occupied residences and the percentage of residents who moved to the neighborhood in 2010 or later. Both variables were loaded on this factor with significantly high loadings (> 0.85), referring to a strong positive association between the two factors. This result

indicates that neighborhoods that contain a greater number of renter-occupied houses experience a higher rate of residential mobility. Similar to the procedure for factor one, a weighted factor score was produced to reflect residential instability. The mapped scores show that most of the neighborhoods experiencing higher residential instability are in the urban core in downtown Austin, Texas (Figure 13). Also, some areas in far north Austin in Williamson County show higher residential instability and mobility. Another hotspot with higher residential instability is in San Marcos in Hays County. This fits the characteristics of this city as a college town. Other counties in the study area and the suburban areas of Travis County show lower residential instability levels and mobility. Unlike poverty rates that showed a distinct division between east and west Austin, there is not much difference in residential instability rates between neighborhoods in east and west Austin.

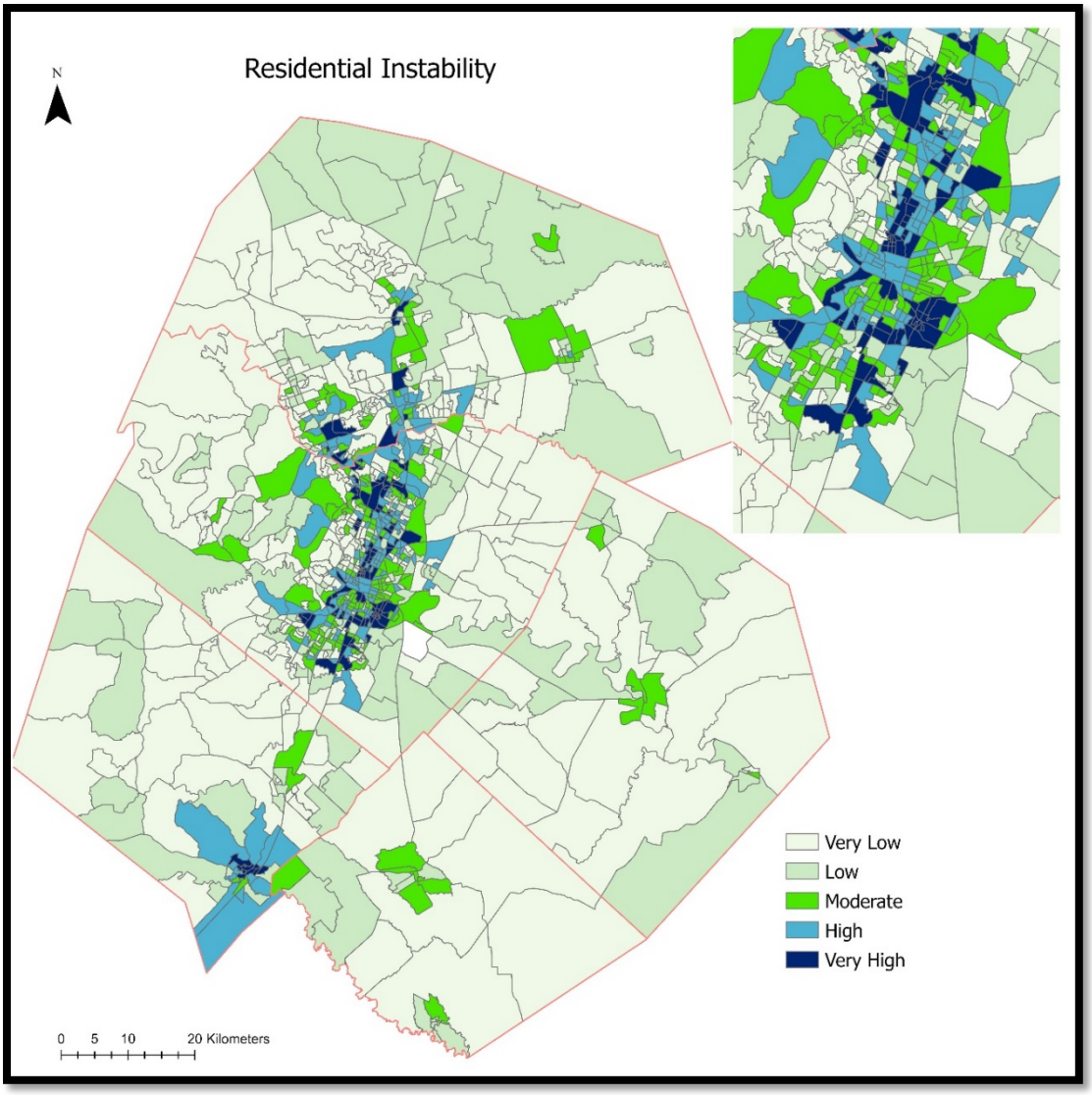

Figure 13. Factor 2 representing residential instability in AMSA.

Minority Concentration

The third factor reflects the historical racial segregation within the study area. The two variables that create this dimension are the percentage of female-headed families and the percentage of African American population loaded, respectively, with a factor of 0.57 and 0.79 on factor three. These two variables are grouped to indicate a greater

concentration of female-headed families in neighborhoods with a higher concentration of African American populations. As the map shows, these neighborhoods are predominantly located in East Austin (Figure 14). This dimension was titled minority concentration, and a factor score was produced that weighted each variable by its factor loading.

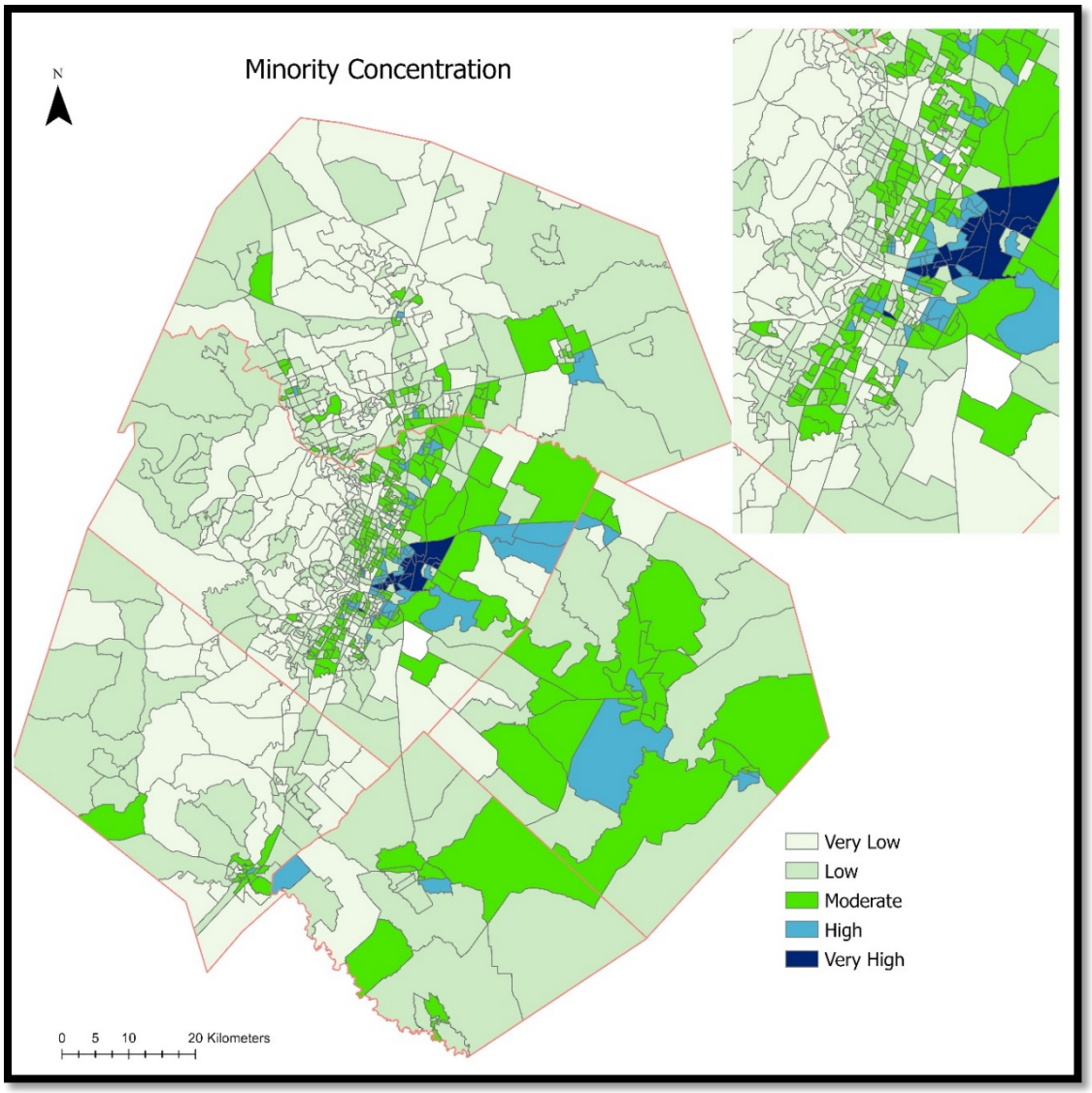

Figure 14. Factor 3 showing minority concentration in AMSA.

Concentrated Disadvantage Index

The scores range from -3.5 (lowest concentrated disadvantage) to 5.6 (highest concentrated disadvantage) with a mean score of -0.37 (SD=1.55). As Figure 15 shows, most of the block groups with a very high concentration of socioeconomic disadvantage are in the eastern side of Austin. The same pattern is valid for the whole study area as the eastern block groups show a higher concentrated disadvantage score. They range between moderate to very high levels of concentrated disadvantage. However, the block groups on the western side of the study area range mostly between moderate to very low levels of concentrated disadvantage.

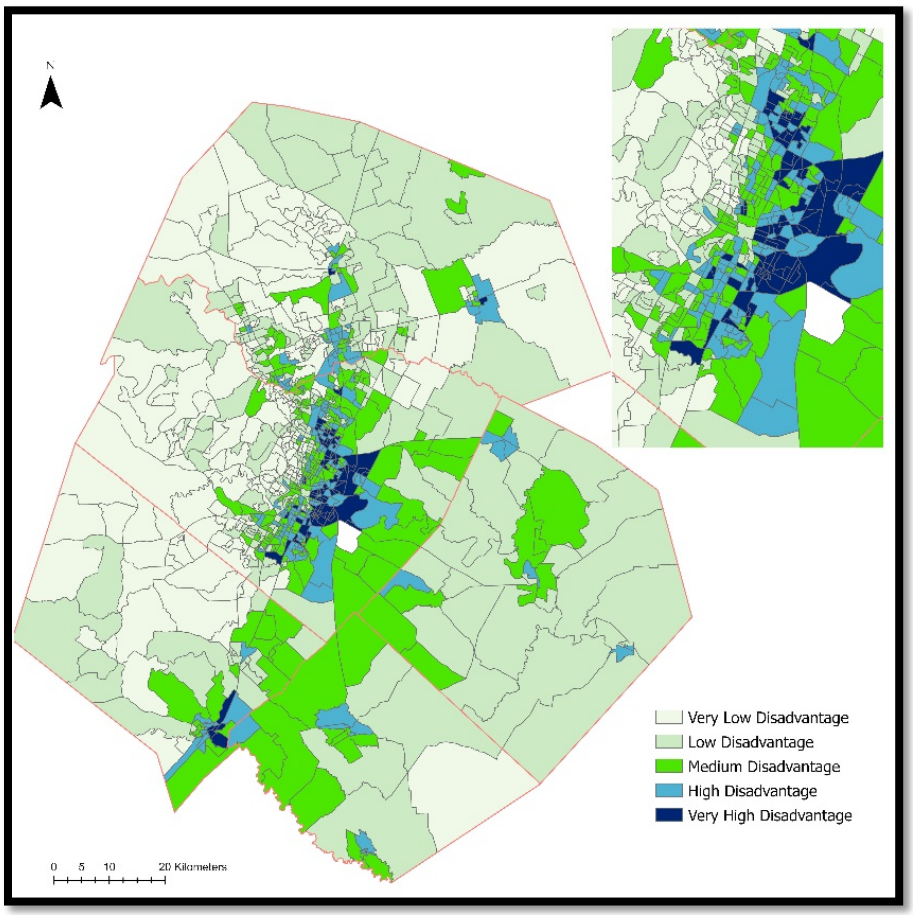

Figure 15. Concentrated Disadvantage Index in AMSA.

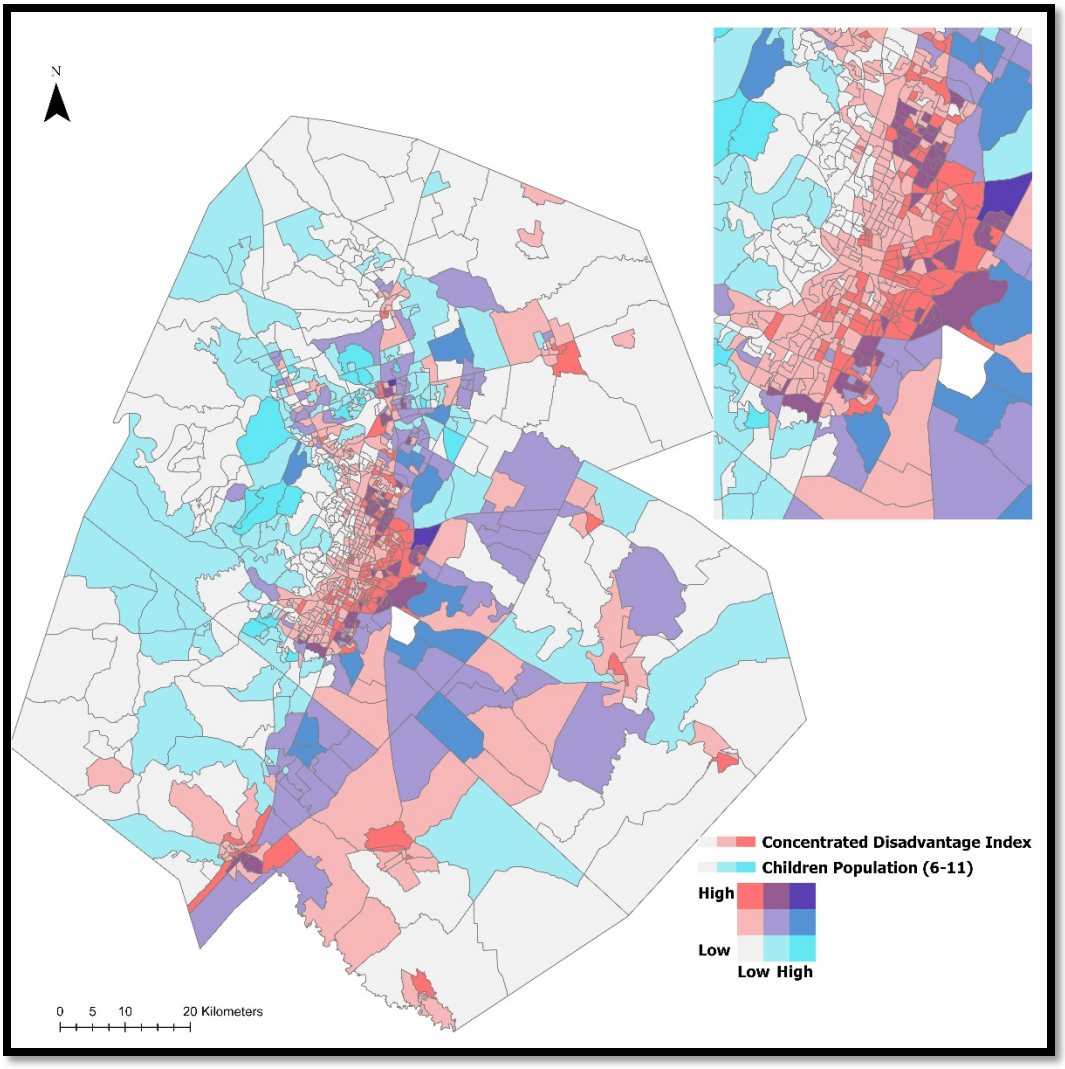

Figure 16. Concentrated Disadvantage Index and the distribution of child population in AMSA.

5.4.2 Neighborhood Child-Friendliness According to Local Knowledge

This section presents the results of the survey and interview questions to answer the second research question: How do Austin parents of elementary-aged children perceive walkability, access to opportunity, and collective efficacy within their neighborhood?

Survey Results

The results of the survey analysis are presented in four phases. The first phase presents results from close-ended questions about sociodemographic and general neighborhood use by parents and children. In the second phase, the results from Likert-scale questions regarding the parental perception of neighborhood walkability, access to opportunity, and collective efficacy are presented. The third phase includes quantitative analysis of differences between expert knowledge and parental perceptions (local knowledge). Finally, the qualitative results of interview responses regarding the differences between expert and local knowledge are discussed.

Sociodemographic

Table 6 presents the results of the descriptive statistics of the survey respondents' socioeconomic characteristics. Four hundred seven surveys were collected from parents in ADMA, while 380 falls within Austin MSA. Most of the surveys were collected from residents of Travis County (n=228), followed by Williamson County (n=89), Hays County (n=51), Bastrop County (n=6), and Caldwell County (n=6). As the survey was restricted to elementary school-aged children's parents, over 80% of the respondents are categorized in the age range of 25 to 45. The second age group is 45 to 55 (11%). Only about 3% of the participants were 18-25, and less than 2% were 55 years old. This is in

line with this research's recruitment criteria of surveying only people who have at least one elementary school-aged child.

The majority of respondents were white (58.7%) and female (62.1%). Others identified themselves as male (36.1%), Hispanic (14.2%), Black or African American (7.1%). Less than 2% declined to declare their gender and race/ethnicity. Almost half of the respondents (46.6%) had educational attainment of bachelor's, master's, or professional degrees. Over 23% of the participants had some college education but no degree, and 15.5% were high school graduates. Along the same lines, more than 35% of respondents had an annual income of over $80.000, and over 28% reported having an annual income between $50.000 to $79.000. However, a significant fraction of participants (18.2%) had an annual income between $30.000 to $49.000. Most participants were married (68.2%), and the rest were single (20%), domestic partners (5.5%), and some (6.4%) either check the "other" category or declined to answer the question regarding their marital status.

Table 6. Descriptive statistics of socioeconomic characteristics.

Variable	Category	Survey Respondents %
Participants	**Total Number**	**380 (100%)**
Age Range	18 - 25	3.20
	25 - 35	40.3
	35 - 45	43.7
	45 - 55	11.1
	55 +	1.80
Gender	Female	62.1
	Male	36.1
	Other	0.30
	Decline to Answer	1.60
Race/Ethnicity	White	58.7
	Hispanic	14.2
	Black or African American	7.10
	American Indian or Alaska Native	0.30
	Native Hawaiian or Pacific Islander	0.30
	Other	1.30
	Prefer not to say	1.80
Education	Some secondary or high school	3.40
	High school graduate	15.5
	Some college, but no degree	23.4
	Associate or technical degree	6.30
	Bachelor's degree	27.9
	Post-graduate masters or professional degree	18.7

	Ph.D., law, or medical degree	4.70
Income	Less than $10,000	5.30
	$10,000-$29,000	7.10
	$30,000 - $49,999	18.2
	$50,000 - $79,999	28.2
	$80,000 +	35.8
	Prefer not to say	5.50
Marital Status	Single	20.0
	Married	68.2
	Domestic Partner	5.50
	Prefer not to say	2.90
	Other	3.40

The survey collected information regarding participants' family situation, household, and neighborhood use (Table 7). Responses to these questions indicated that most respondents (64.5%) have only one elementary school child. Almost a third of the respondents (27.4%) have two children going to elementary school. Along these lines, most of the respondents (61.1) reported that 4 to 6 people live in their household, with over 70% reporting that the number of adults in the household is 2. One-third of the respondents claimed that no other family members live in their household, while over half (53.4%) reported that 1 to 3 other family members live with them. A majority of respondents have lived in Austin, Texas for over ten years (54.7%), while less than 20% have lived in their current neighborhood for over ten years. Most participants lived in their current neighborhoods between 3 to 5 years (23.9%), followed by 18.4% who lived in their neighborhood between 5 to 10 years. A little less than a third of the respondents

reported having lived in their current neighborhood less than a year or between 1 to 2 years. A larger group of respondents estimated the distance between their residents and their child/children's school is between 1 to 5 miles (46.3%), and over half (59.2%) travel the same distance to shop most of their grocery.

Table 7. Descriptive statistics of family composition and life experience.

Variable	Category	Survey Respondents %
N. of children in elementary school N= 379 (99.7%)	1	64.5
	2	27.4
	3	7.4
	4	0.5
Household size N = 377 (99.2%)	1-3	29.50
	4-6	61.1
	7+	8.9
N. of adults live in the household N= 379 (99.7%)	1	11.6
	2	73.7
	3	10.0
	4+	4.2
N. of other family members live in the household N= 379 (99.7%)	0	33.4
	1-3	53.4
	4-6	12.4
	7+	0.6
Years lived in Austin, Texas N= 380 (100%)	Less than a year	5.3
	1-2 years	7.9
	2-3 years	6.1
	3-5 years	8.4
	5-10 years	17.6
	10+ years	54.7
Years lived in the current neighborhood N= 380 (100%)	Less than a year	12.9
	1-2 years	13.9
	2-3 years	11.1

	3-5 years	23.9
	5-10 years	18.4
	10+ years	19.7
Estimated distance (in miles) from home school N= 380 (100%)	Less than 1 mile	25.8
	1-5 miles	46.3
	5-10 miles	16.3
	10-15 miles	5.3
	15+ miles	6.3
Estimated distance traveled for food shopping N= 380 (100%)	Less than a mile	11.8
	1-5 miles	59.2
	6-10 miles	21.1
	11-15 miles	6.3
	15+ miles	1.6

Behavioral Questions

The results of the behavioral questions are presented in Table 8. Over half of the respondents (55.8%) stated that they interact with 1 to 5 people and some (20%) said they interact with 6 to 10 people in their neighborhood. An equal percentage of participants reported that their children play on their streets daily (26.6%) or two to four times per week (26.6%). One the same lines, more than one-third of the parents indicate that their child/children visit a park or a playground once or more times a week (37.6%). When parents asked whether they allow their child/children to travel on their own or with friends, a majority reported that their child/children is/are not allowed to travel on their own (53.4%), and a little less than half said their child/children is/are not allowed to travel with their friends (46.6%). Approximately one-third of parents reported that their child/children is/are allowed to travel on their own for a distance of 1-15 minutes in their neighborhood. Others allow their child/children to travel a distance of 1-15 minutes

(29.7%) and 15-30 minutes (16.8%) with friends.

Table 8. Behavioral questions involving the survey respondents and their children.

Variable	Category	Survey Respondents %
Participants	Total Number	380 (100%)
N. of times your child/children play on your street per week N= 380 (100%)	Daily	26.6
	Once a week	8.70
	A few times a week (2-4 times)	26.6
	Several times a week (4-6 times)	8.40
	My child/children do not play on my street.	29.7
N. people you interact with in your Neighborhood N= 380 (100%)	1-5	55.8
	6-10	20.0
	11-15	6.80
	15+	3.20
	I do not interact with people in my neighborhood	14.2
N. times your child/children visit a park or playground in your neighborhood N= 380 (100%)	Daily	8.40
	Once or more times a week	37.6
	1 to 3 times a month	26.1
	Several times a year (5-11 times a year)	9.20
	A few times a year (2-4 times a year)	4.20
	Once a year or less	2.90
	My neighborhood does not have parks or playgrounds.	11.6
Estimated distance (in minutes) from home you are your child/children is/are allowed to travel on their own N= 380 (100%)	1-15 minutes	31.1
	15-30 minutes	9.70
	30-60 minutes	4.70
	60+ minutes	1.10
	I do not allow my child/children to travel on their own.	53.4

Estimated distance (in minutes) from home you are your child/children is/are allowed to travel with friends N= 380 (100%)	1-15 minutes	29.7
	15-30 minutes	16.8
	30-60 minutes	4.50
	60+ minutes	2.40
	I do not allow my child/children to travel with friends.	46.6

Walkability

The survey contains five questions to capture parents' perceptions of their neighborhood's walkability regarding their children. The results of these questions are presented in Table 9. Almost 80% of respondents reported that their neighborhoods have sidewalks. Overall, 60% reported that the sidewalks in their neighborhoods are well-maintained, while only 5% reported the opposite. Over 66% of respondents agreed that their children use the sidewalks within their neighborhood and over half of them believe that their neighborhood is safe for their child/children to play alone and with friends. A smaller group of parents do not agree that their neighborhood is safe enough for their child/children to play alone (19.7%) and with friends (12.4%). Lastly, more than 60% of parents agreed that the trees in their neighborhood provide enough shade for pedestrians, while about 16% did not agree, and 4.2% reported that their neighborhoods do not have trees.

Table 9. Descriptive statistics of the responses to walkability questions.

Variable	Category	Survey Respondents %
Participants	**Total Number**	**380 (100%)**
Does your neighborhood have sidewalks?	Yes	79.2
	No	20.8
The sidewalks in our neighborhood are well-maintained.	Strongly agree	32.1
	Agree	30.3
	Neutral	11.8
	Disagree	3.90
	Strongly disagree	1.10
	My neighborhood does not have sidewalks.	20.8
My child/children use the sidewalks in our neighborhood often.	Strongly agree	37.9
	Agree	28.2
	Neutral	8.40
	Disagree	3.70
	Strongly disagree	1.10
	My neighborhood does not have sidewalks.	20.8
Our neighborhood is safe for my child/children to walk or play alone.	Strongly agree	19.7
	Agree	33.7
	Neutral	26.8
	Disagree	12.9
	Strongly disagree	6.80
Our neighborhood is safe for my child/children to walk or play with friends.	Strongly agree	27.6
	Agree	41.3
	Neutral	18.7
	Disagree	8.20
	Strongly disagree	4.20
The trees in my neighborhood provide shade for pedestrians.	Strongly agree	26.1
	Agree	36.3
	Neutral	16.3
	Disagree	12.9
	Strongly disagree	3.20
	My neighborhood does not have trees.	4.20
	Not sure	1.10

In addition to descriptive results, an overall walkability score was generated by summing the weights associated with the Likert-scale categories for all five questions. The scores were categorized as very low, low, moderate, high, and very high, and their spatial distribution is presented in Figure 17.

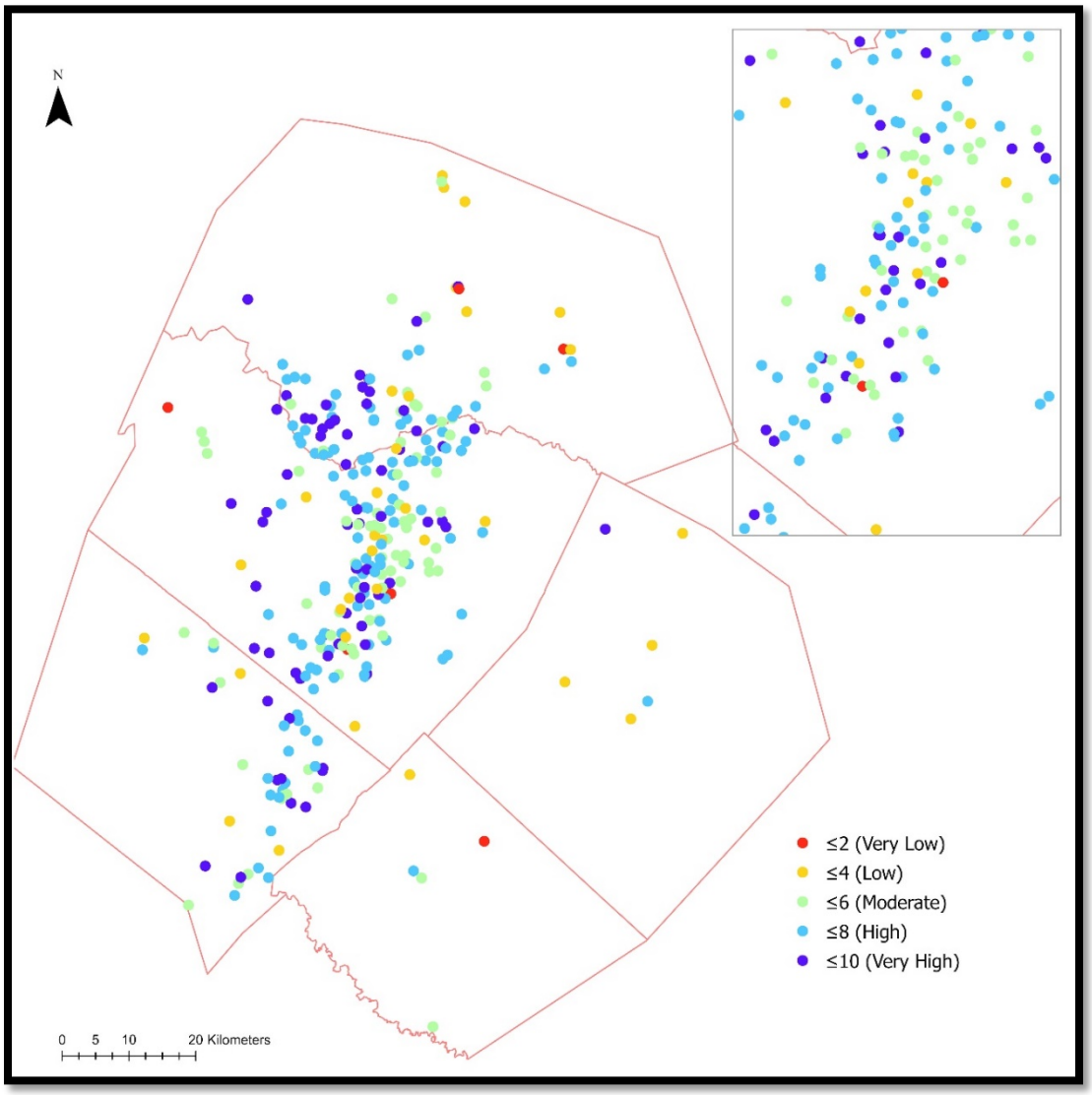

Figure 17. Walkability scores based on local knowledge in AMSA.

Simple visualization of the scores does not seem to provide any specific patterns in the walkability scores. Thus, as explained in the analysis section, conducting a cluster

analysis using the Optimized Hot Spot analysis tool in ArcGIS Pro 2.7 may help detect clusters if there is any in the data. Figure 18 shows the results of the Optimized Hot Spot Analysis. In this figure, a hot spot (red shade) indicates a cluster of positive opinions regarding walkability (higher score), while a cold spot represents a cluster of negative opinions regarding walkability (lower scores). The most significant hotspot (99%) is around the Cedar Park area in far North West Austin in Williamson County.

Some block groups around the same area show significant hot spots with a 95% confidence level. With 90% and 95% confidence levels, a few other hot spots exist in South Austin neighborhoods. Cold spots are located in one block group in East Austin with a 99% confidence level and a few others in nearby block groups with a 95% confidence level.

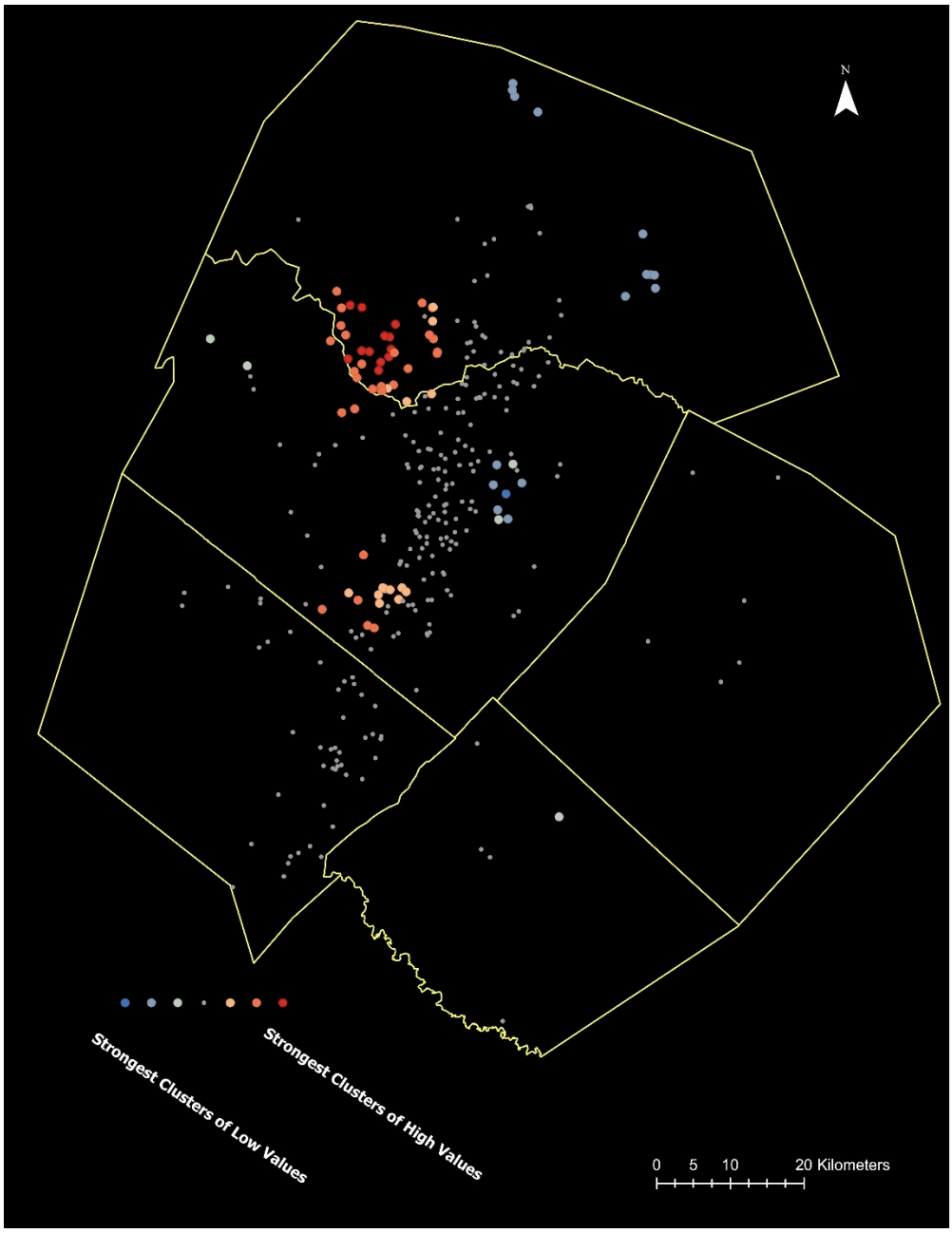

Figure 18. Optimized Hotspot Analysis of local walkability scores.

Opportunity

The survey contained five questions to capture parents' perceptions about their neighborhood's access to diverse opportunities that interest their children (Table 10). These opportunities included convenient access to school, health care, parks, and playground, and whether their neighborhood offered their children a location to socialize

with friends. The descriptive analysis of the answers is presented in Table 10.

Overall, Parental perception regarding convenient access to school was significantly positive (88.4%). Also, many parents (81.1%) said that they have adequate access to health care. The same trend is valid for access to parks and playgrounds (75.5%). Over half of the respondents (64.4%) reported that parks and playgrounds in their neighborhoods are well designed, and their neighborhoods have spaces where children use to socialize (57.9%). However, about 14% of the respondents disagreed or strongly disagreed about adequate access to parks and playgrounds, and 10% said they do not have any parks and playgrounds within their neighborhoods. About 20% of parents disagreed or strongly disagreed that their neighborhood offered their children a place to socialize with friends. About 22% were neutral or not sure about this aspect of their neighborhood.

The individual scores based on each response were added to create an opportunity score for each respondent. Figure 19 shows the spatial distribution of opportunity scores, and each point represents a survey respondent's location. Darker blue and lighter blue colors show higher scores, thus positive opinion regarding access to opportunity. Light green-colored points show moderate scores, and yellow and red, respectively, indicate lower scores (more negative opinions) about access to opportunity. Over 70% of respondents (70.7%) gave a high or very high opportunity score to their neighborhoods, while 16.5% rated their neighborhood as a moderate opportunity area, and almost 13% gave a low or very low score.

Table 10. Opportunity scores based on local perception.

Variable	Category	Survey Respondents %
Participants	Total Number	380 (100%)
My family has convenient access to schools.	Strongly agree	48.9
	Agree	39.5
	Neutral	8.70
	Disagree	2.60
	Strongly disagree	0.30
My family has convenient access to health care.	Strongly agree	43.2
	Agree	37.9
	Neutral	12.1
	Disagree	6.10
	Strongly disagree	0.80
There are parks and playgrounds in our neighborhood.	Strongly agree	37.1
	Agree	38.4
	Neutral	9.20
	Disagree	7.10
	Strongly disagree	7.10
The parks and playgrounds in our neighborhood are well designed.	Strongly agree	28.4
	Agree	36.1
	Neutral	17.1
	Disagree	6.10
	Strongly disagree	2.40
	No parks	10.0
Our neighborhood has spaces that my child uses to socialize with friends.	Strongly agree	20.0
	Agree	37.9
	Neutral	18.4
	Disagree	10.8
	Strongly disagree	8.90
	Not sure	3.90

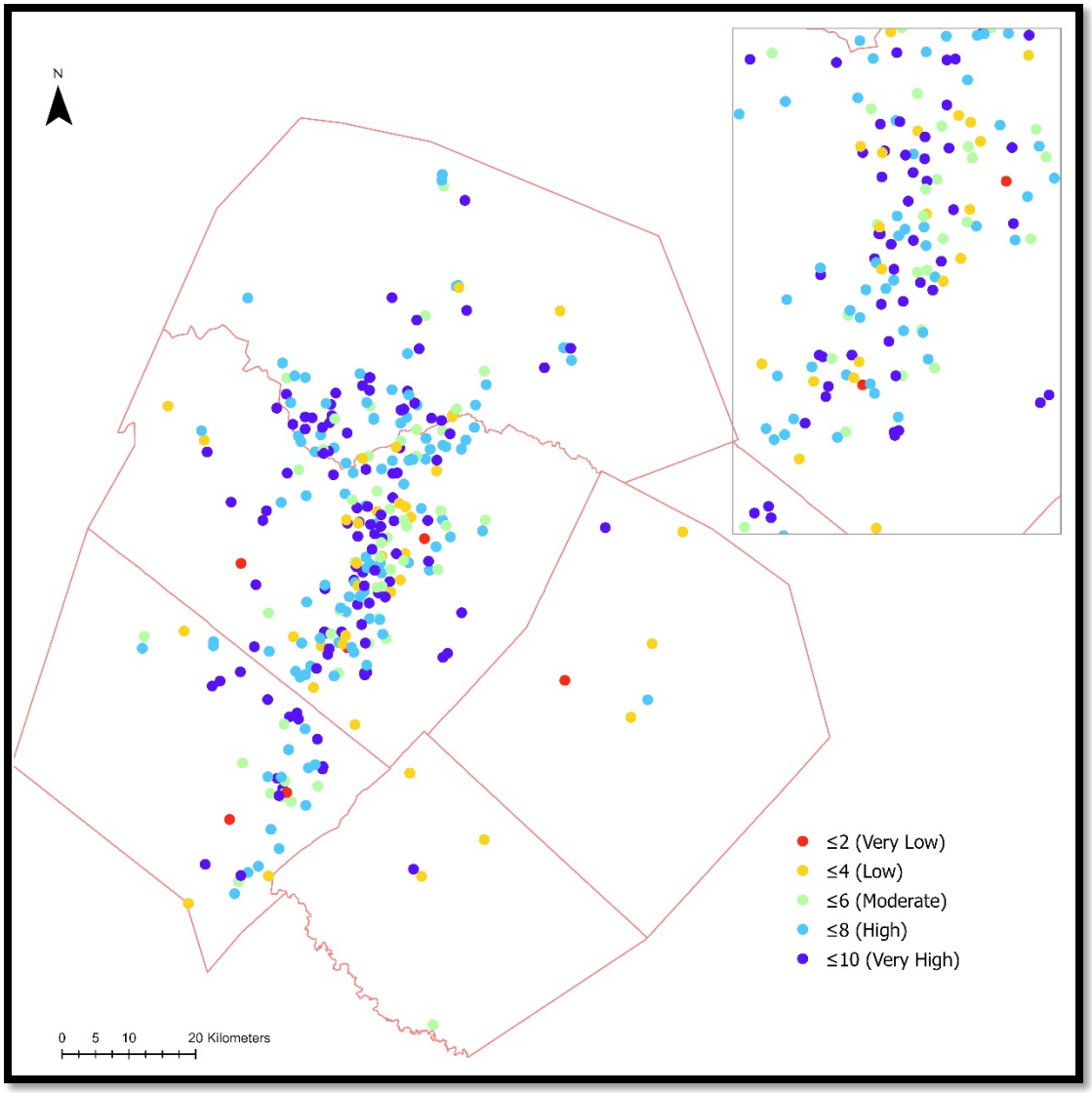

Figure 19. Opportunity scores according to AMSA parents.

To observe any clusters among the local opportunity scores, an Optimized Hot Spot analysis was run. Unlike local walkability, the results did not show any strong clustering within the data (Figure 20). One cluster of a moderate hot spot is detected, which is 90% significant. This hot spot of positive opinion regarding access to opportunity is around the Cedar Park area in Austin's northern part of Williamson county. It seems that there is a moderate cold spot (90%) in a couple of block groups in the East Austin area.

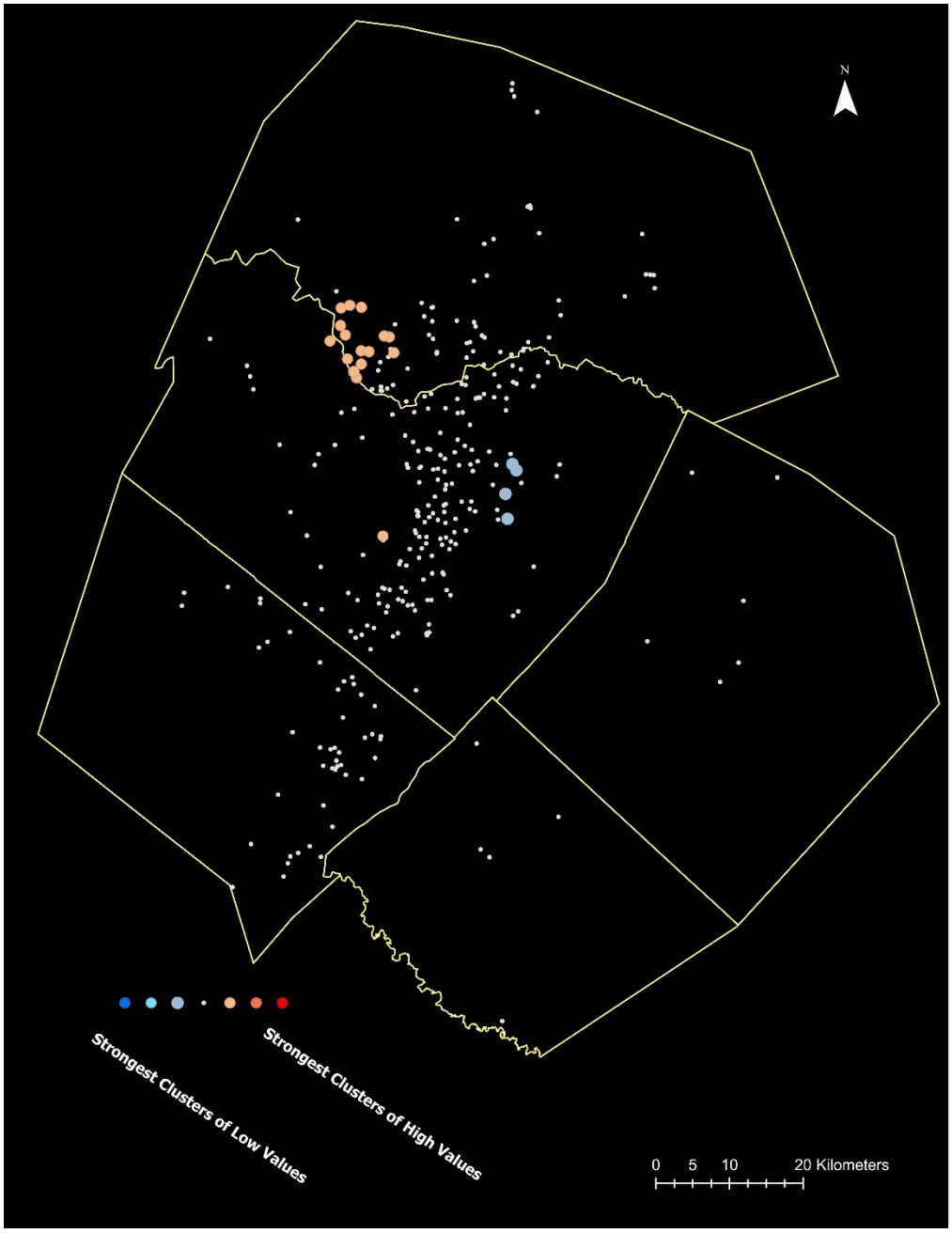

Figure 20. Optimized Hotspot Analysis of local opportunity scores.

Collective Efficacy

As for walkability and access to opportunity, the survey contains five questions to

capture parents' perceptions of their neighborhood's social environment. These questions were designed to understand the neighborhood's potential to generate collective efficacy to support children. The frequency of responses to these questions is presented in Table 11. Overall, a majority of parents stated that they are in contact with neighbors whose children go to the same school as my child/children (61.6%) and that they count on their neighbors to intervene if children are involved in illegal or destructive behavior in their neighborhoods (64.5%). Also, over half of the respondents reported that most of their neighbors have lived in their neighborhood for at least five years (60.5%) and that there are adults in their neighborhood that their child/children can look up to (55.8%). However, a little less than half of the respondents agreed that they trust their neighbors to look after their child/children (43.9%), while a significant percentage of parents (36.5%) reported that they do not trust their neighbors in this regard.

Table 11. Descriptive statistics of the responses to collective efficacy questions.

Variable	Category	Survey Respondents %
Participants	Total Number	380 (100%)
I am in contact with neighbors whose children go to the same school as my child/children.	Strongly agree	32.9
	Agree	28.7
	Neutral	17.1
	Disagree	10.3
	Strongly disagree	11.1
I trust my neighbors to look after my child/children when I am not available.	Strongly agree	20.0
	Agree	23.9
	Neutral	19.5
	Disagree	16.8
	Strongly disagree	19.7
Most of my neighbors have lived in our neighborhood for at least five years.	Strongly agree	29.7
	Agree	30.8
	Neutral	12.6
	Disagree	9.50
	Strongly disagree	5.00
	Not sure	12.4
There are adults in my neighborhood that my child/children can look up to.	Strongly agree	27.4
	Agree	28.4
	Neutral	21.1
	Disagree	7.60
	Strongly disagree	3.90
	Not sure	11.6
I can count on my neighbors to intervene if children are involved in illegal or destructive behavior in my neighborhood.	Strongly agree	30.0
	Agree	34.5
	Neutral	12.9
	Disagree	6.30
	Strongly disagree	5.50
	Not sure	10.8

Following the same procedure as what was done for walkability and opportunity, an overall score was created for collective efficacy based on the responses to the

questions listed in Table 11. The scores are classified on a scale of 1 to 10, and their spatial distribution is illustrated in Figure 21. Over half of the scores are above 7 (59.2%), indicating that most respondents have a positive perception of the interaction among neighbors and social relations. About 24% of scores show a moderate opinion, and approximately 17% show a negative perception (scores ≤ 4).

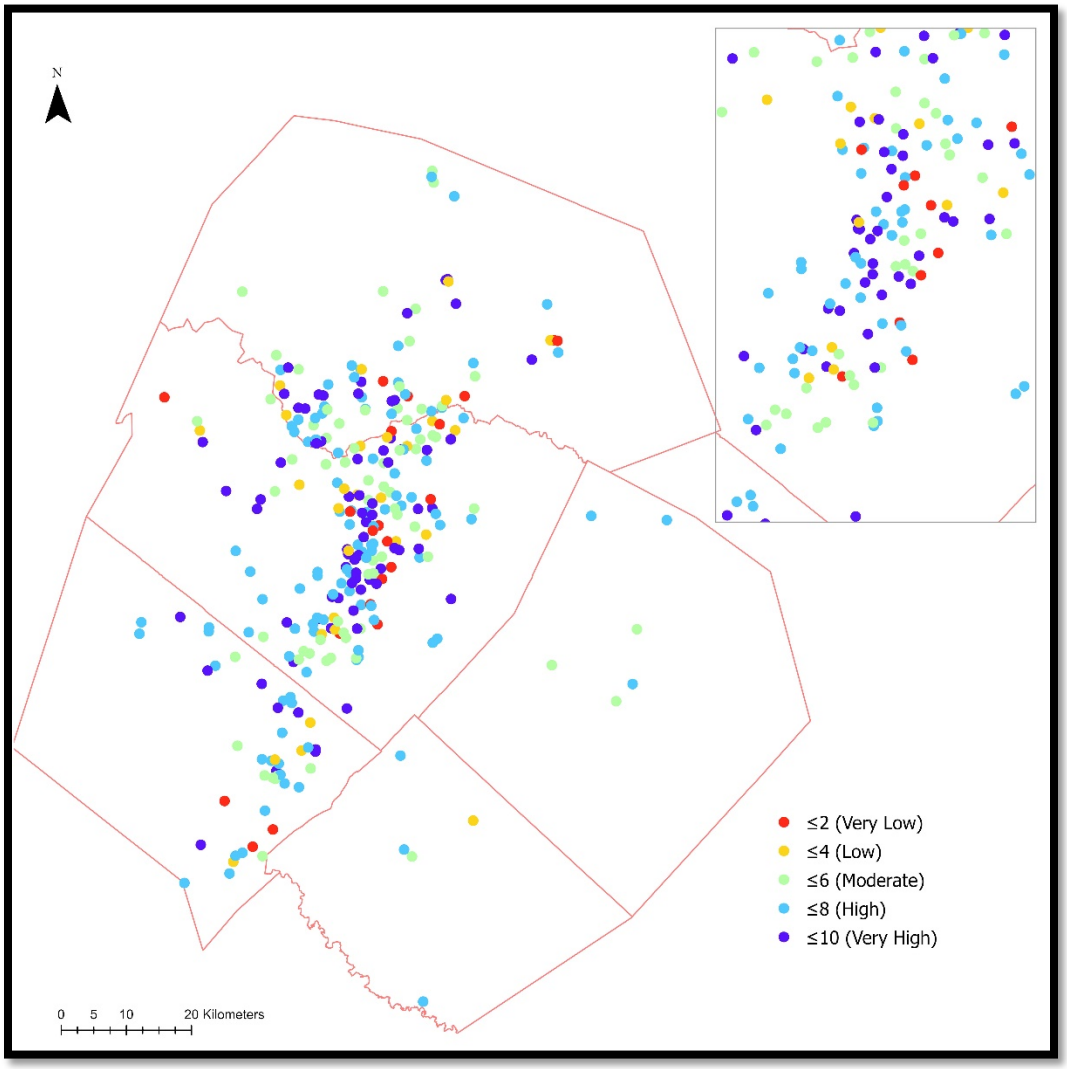

Figure 21. Collective efficacy scores according to AMSA parents.

One cluster of hot spots was found in West Austin neighborhoods by running the Optimized Hot Spot Analysis. These hotspots are significant with a confidence level of 99%, meaning that survey respondents in these areas had a positive opinion regarding their neighborhoods' social environment and its potential of generating collective efficacy for children.

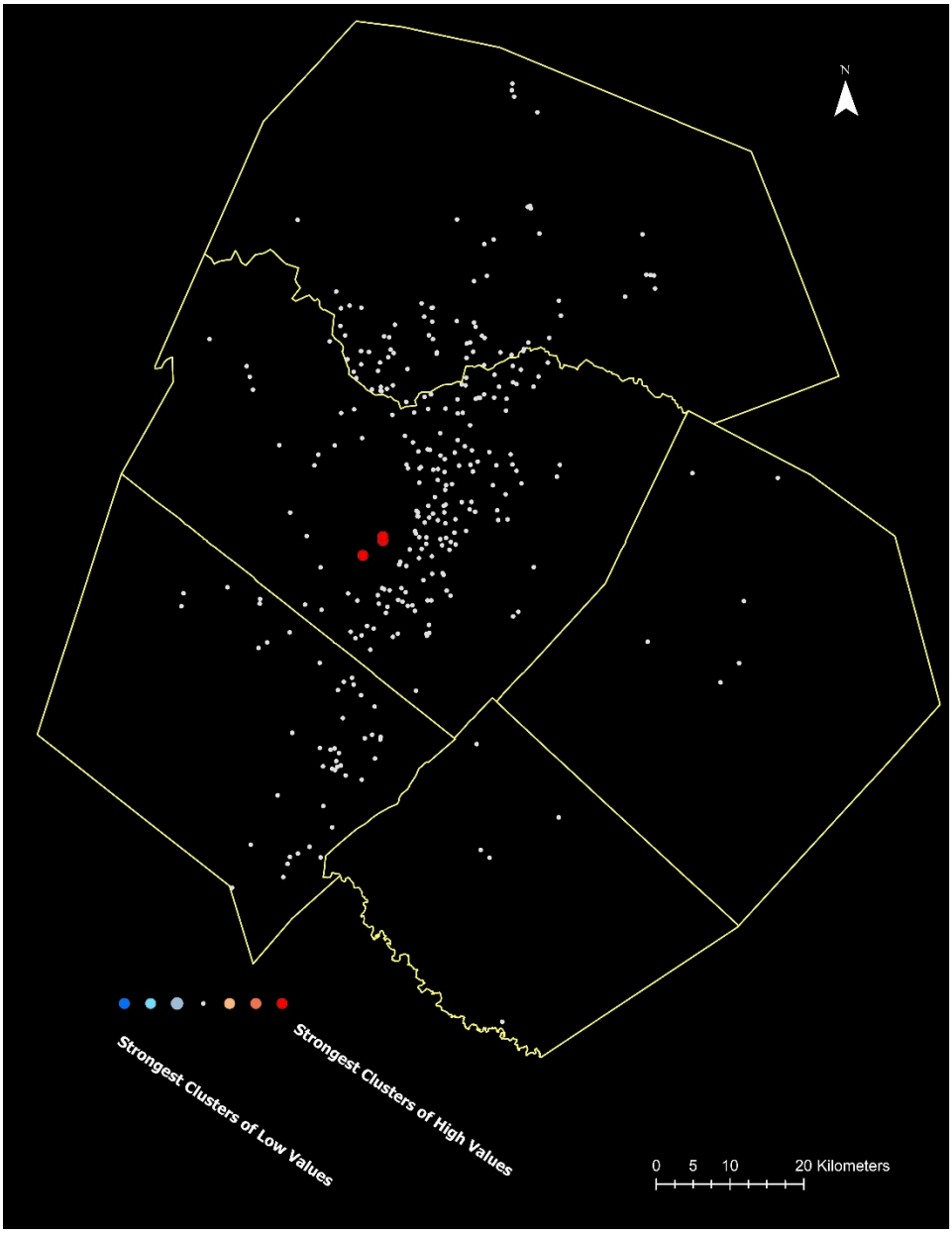

Figure 22. Optimized Hotspot Analysis of local collective efficacy scores.

5.4.3 Difference between Expert and Local Knowledge

This section presents the difference between the expert and local representations of child-friendliness to answer the third research question: What are the quantitative and qualitative differences between urban planning indices (expert knowledge) and parents' perceptions and experiences raising children within the study area?

The quantitative results are presented first based on the numeric difference of expert and local scores regarding walkability, opportunity, and collective efficacy. The difference is calculated by subtracting expert scores from local scores (which both were previously classified on a scale of 1 to 10). If the subtraction result is negative, it indicates that parents' scores are higher than the expert scores. In other words, it shows that parents had a better opinion compared with what experts think about that location. A positive number, instead, indicates that the expert scores are higher than the local score. Regardless of whether the number is negative or positive, the greater the numbers, the greater the difference between the expert and local scores.

Walkability

The quantitative difference in walkability scores was calculated by subtracting the Walk Scores from the scores that the survey respondents gave to their neighborhoods. Both scores were classified based on the same scale before calculating the difference. Figure 23 shows the spatial distribution of difference scores. The range of scores goes from -9 to 6, with a negative sign indicating that parents gave a higher score to their neighborhood's walkability than what Walk Score shows. On the same line, positive scores indicate that the Walk Score for that area is higher than a parent's score. As

mentioned before, regardless of the sign, the larger the numbers, the greater is the difference between the expert and local scores.

The points colored with blue shades show places where expert indices rated walkability better than local parents (Figure 23). It seems that the prevalence of this condition is more visible around Austin Downtown. On the other hand, the yellow, orange, and red colors show that local opinions about their neighborhoods' walkability are better than what expert scores assigned. This condition seems to be present in Austin's north western parts in Travis and closer to Williamson County. Also, places between Kyle and Buda in Hays County seem to meet this condition. Most walkability difference scores are negative (81.8%), meaning that most parents rated their neighborhoods' walkability better than Walk Score's score. About 12% of difference scores are positive, and approximately 6% are 0. The 0 difference scores mean that expert and local scores were equal.

Optimized Hot Spot analysis was run to look for clusters of hot spots or cold spots among walkability difference scores. A hot spot indicates that in those areas, most of the difference scores are positive. Thus, the Walk Scores are higher than local scores. A cold spot means that in those are local scores are higher than Walk Scores. These are areas with a negative walkability difference score.

A 99% significant hotspot has been detected in neighborhoods in Austin downtown. Comparing Figure 23 and 24, it can be deduced that these areas are where expert scores are higher than scores assigned by parents. According to the expert score, Walk Score, these neighborhoods are very walkable, while parents reported the opposite. On the same line, two clusters of cold spots have been detected at over 95% confidence

level: one in northern areas of Austin within Williamson County and another in southern areas of Austin within Hays County. In these areas, parents assigned a better walkability score than what Walk Score shows.

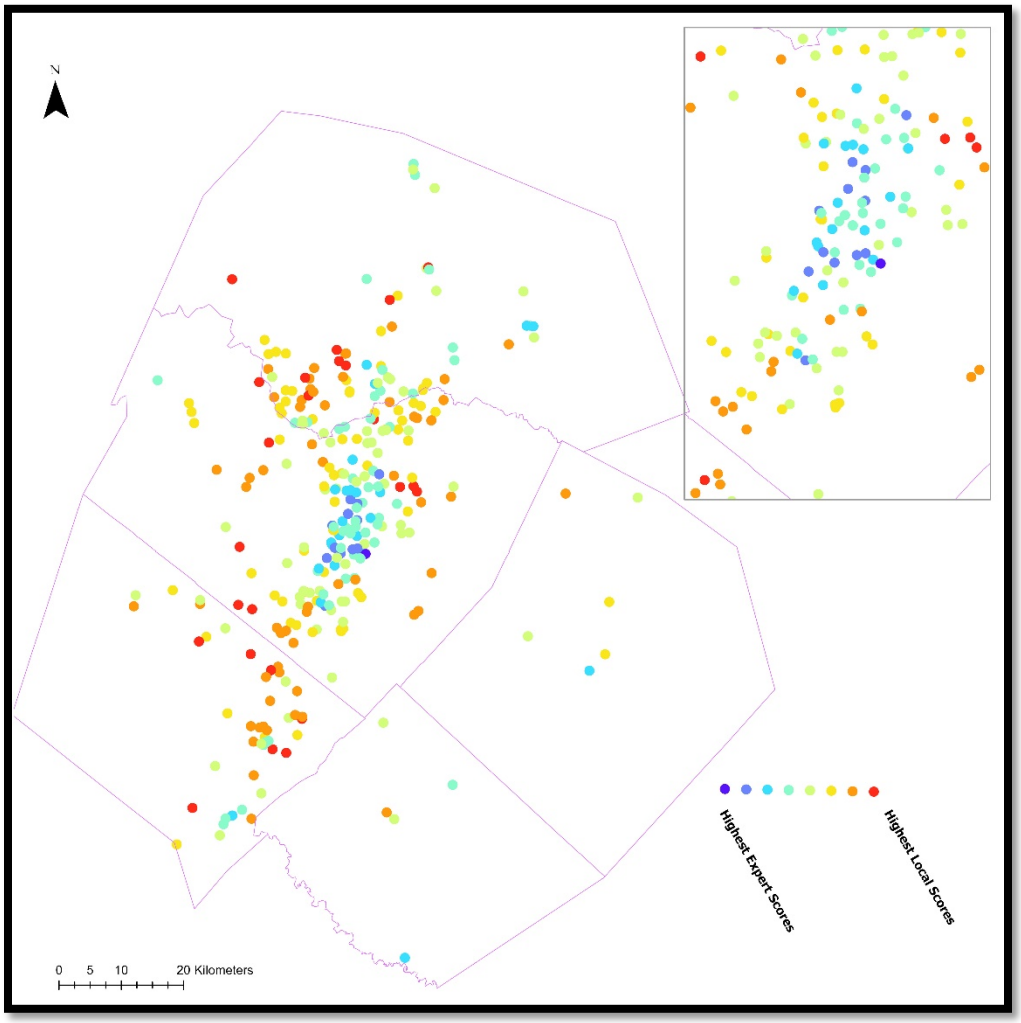

Figure 23. Difference between walkability expert and local scores in AMSA.

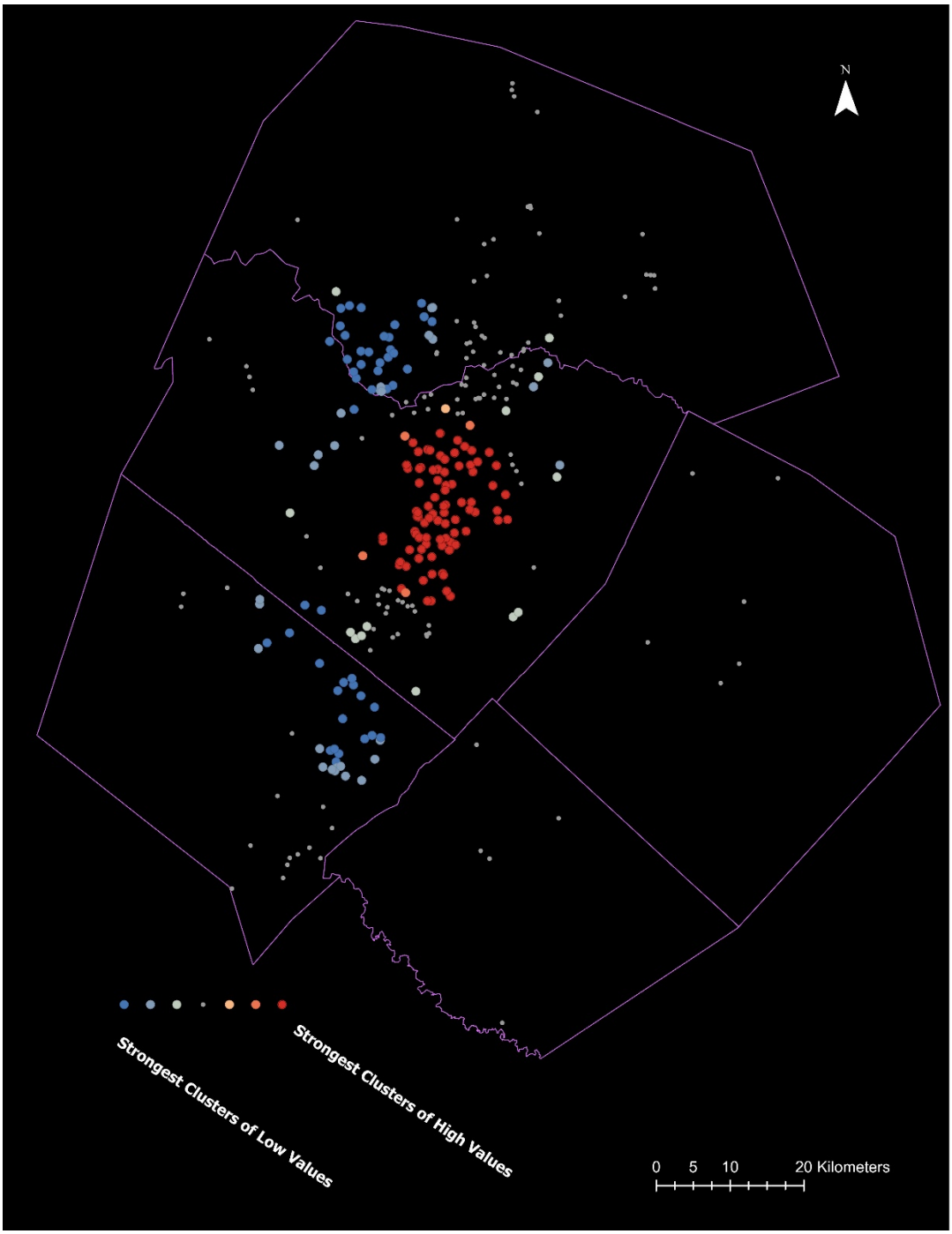

Figure 24. Optimized Hot Spot Analysis of walkability difference scores.

Access to Opportunity

The quantitative difference between the expert and local opportunity scores was

found by subtracting the expert scores from the parents' scores by answering the five questions about access to opportunity within their neighborhoods. Both scores were classified on a scale of 1 to 10 before calculating the difference. Figure 25 shows the spatial distribution of opportunity difference scores with Austin MSA. The range of scores goes from the lowest score -9 to the highest score 7. The positive values are shown with two shades of blue and negative values with yellow, orange, and red colors.

Like walkability difference scores, most of the opportunity difference scores are negative (67.6%), showing that parents rated access to opportunity within their neighborhood better than expert scores (COI). Slightly over one-fifth of difference scores (21.3%) are positive. These scores indicate that COI assigned a higher score than the scores that parents gave to those neighborhoods, and about 11% were 0, indicating no difference between an expert and local score.

To understand whether there are any clusters of negative or positive difference scores, Optimized Hot Spot analysis was used (Figure 26). The results show only one cluster of cold spots (99% significant) that extends from the downtown to southern and eastern neighborhoods in Austin. In these neighborhoods, parents gave higher opportunity scores compared to COI. Figure 26 does not show any significant cluster of hot spots; only a couple of hot spots located in northwestern areas of Austin where parents gave a lower score to access to opportunity than the scores that expert index (COI) assigned to those neighborhoods.

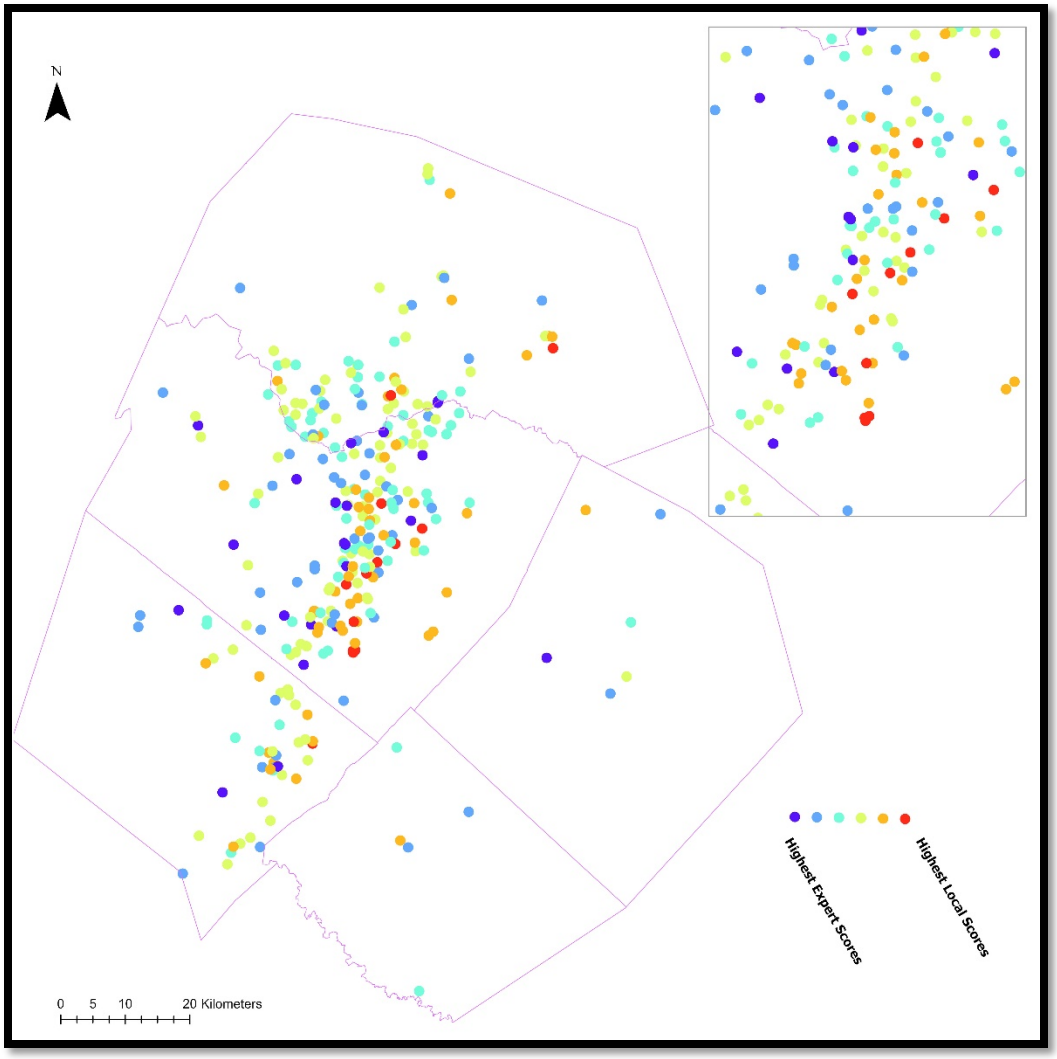

Figure 25. Difference between opportunity expert and local scores in AMSA.

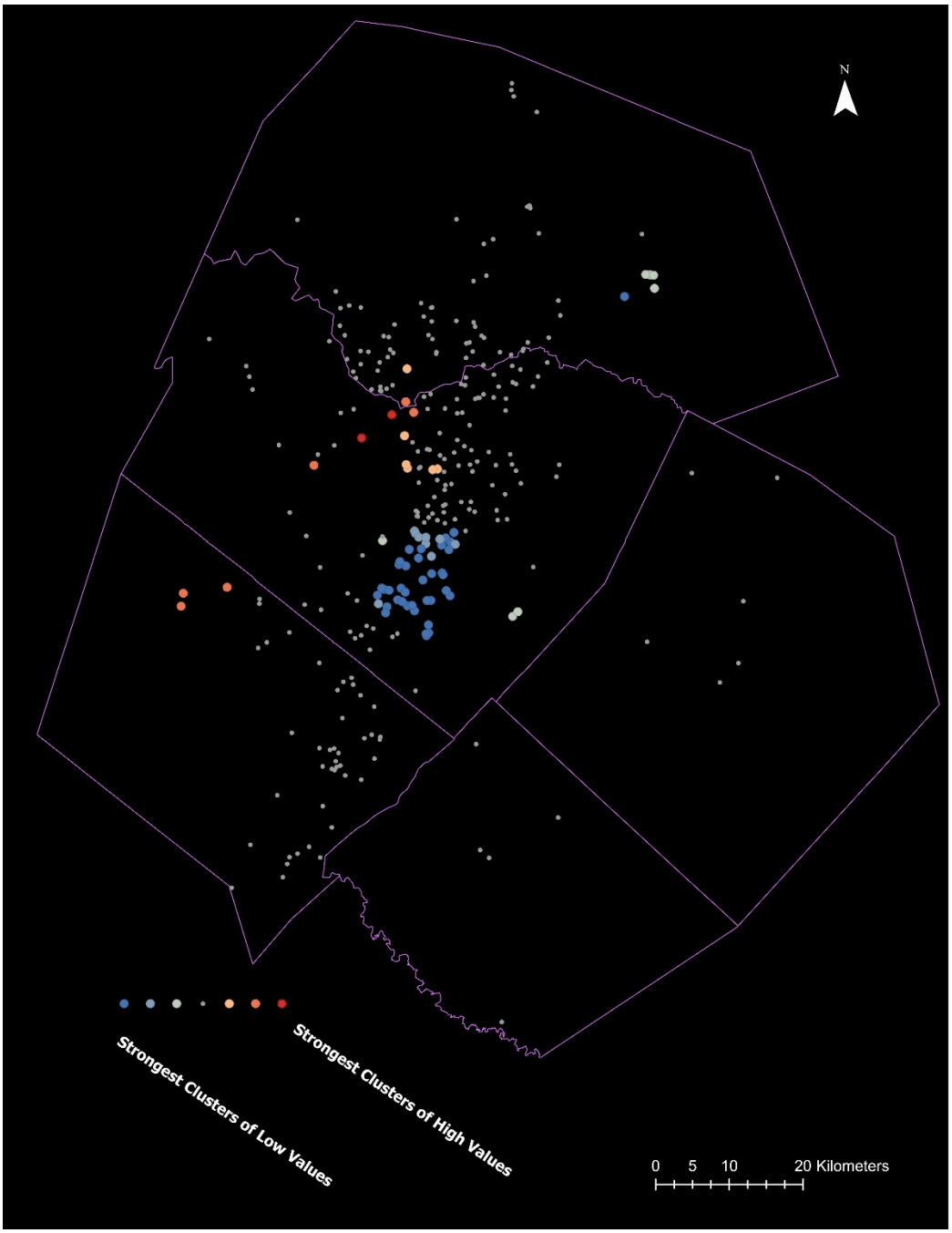

Figure 26. Optimized Hot Spot Analysis of opportunity difference scores.

Collective Efficacy

The quantitative difference between the expert and local scores was calculated by subtracting the expert scores (concentrated disadvantage index) from the parents' scores. Both scores were classified on a scale of 1 to 10 before calculating the difference. The range of collective efficacy difference scores goes from the lowest score -9 to the highest score 7. Figure 27 shows the difference scores' spatial distribution using two shades of blue for positive values, light green for 0, and yellow, orange, and red for negative values.

Like walkability and opportunity difference scores, a great percentage of collective efficacy difference values are negative (78.1%). The remaining values are mostly positive (11.8%) and zeros (6.5%). The spatial pattern of colors in Figure 27 shows a consistent pattern in Western block groups' negative values in the study area. To see whether there are significant clusters of positive and negative scores, an Optimized Hot Spot analysis was run.

The results of this analysis (Figure 28) show a few significant clusters in the data. A hot spot (99% significant) extends from Austin Downtown to the eastern neighborhoods, indicating a prevalence of positive numbers. This means that parents in these neighborhoods gave a lower score to their neighborhood’s social environments than the expert score. A few cold spots have been found in northern, western, and southern areas of Austin, respectively, in Travis, Williamson, and Hays counties. The darker blue indicates that the results are more significant (99%), and lighter blue indicates a 95% confidence level. The cold spots are areas where parents’ opinions about their neighborhoods' social environment are better than what expert scores show.

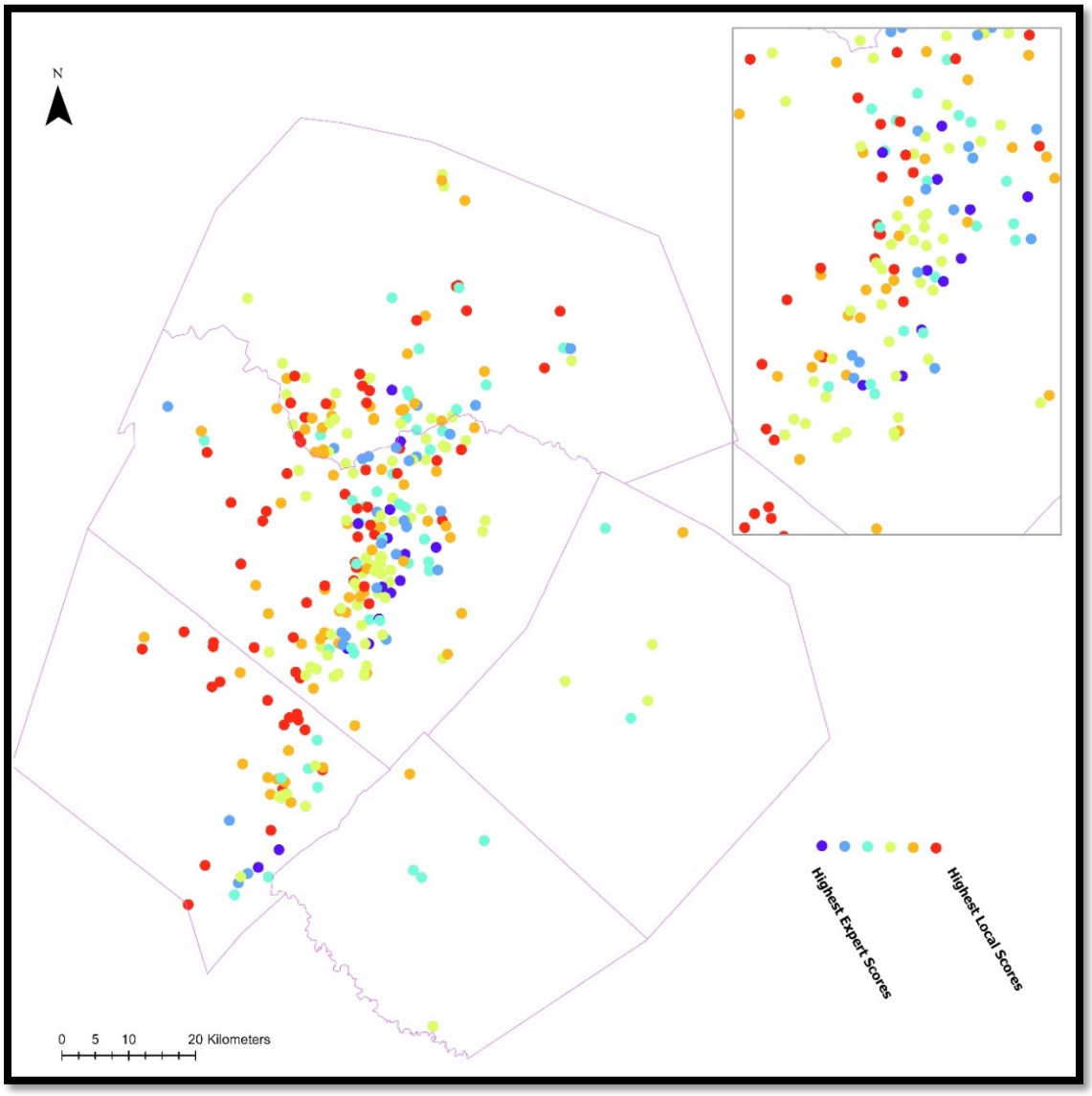

Figure 27. Difference between collective efficacy expert and local scores in AMSA.

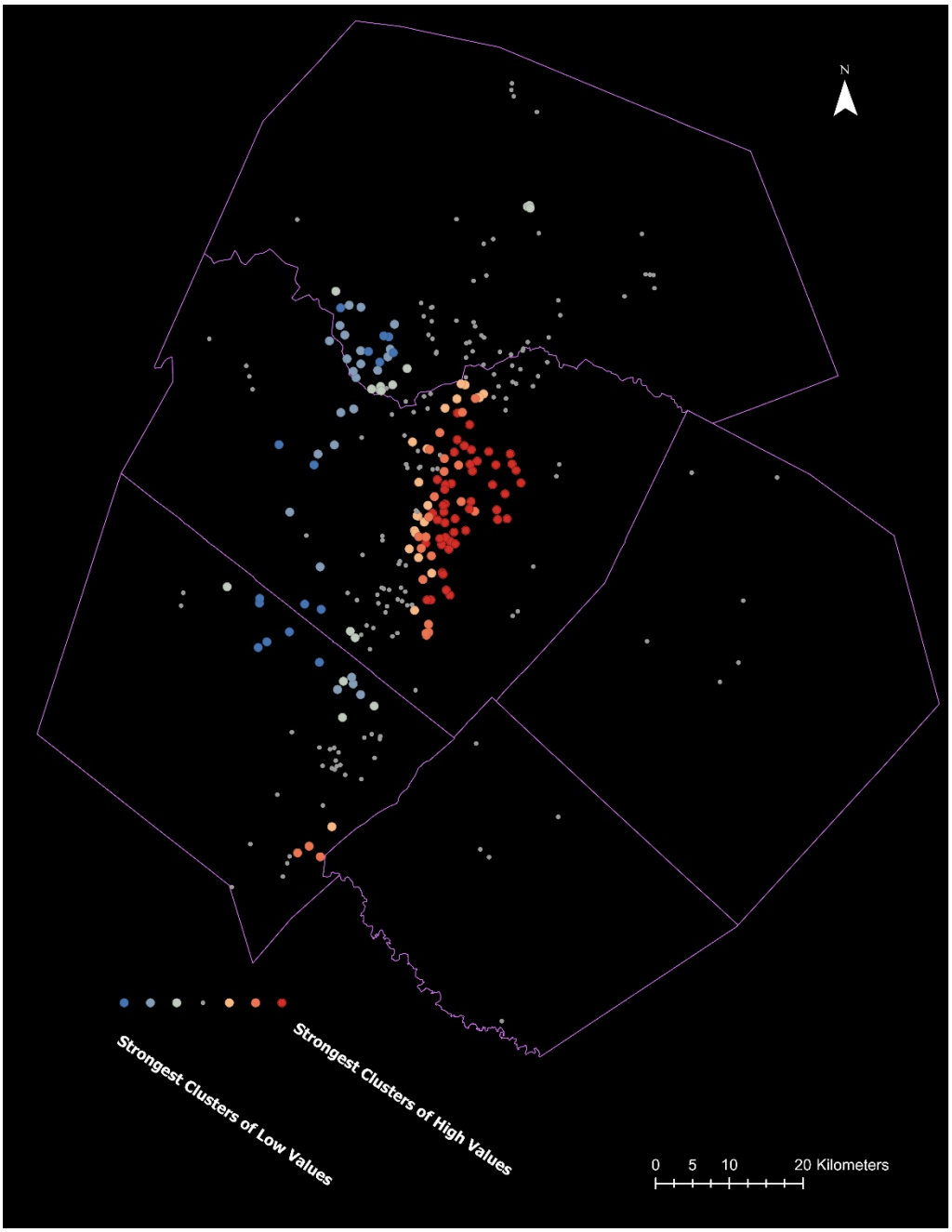

Figure 28. Optimized Hot Spot Analysis of collective efficacy difference scores.

Overall Difference

After conducting hotspot analysis to find clusters based on individual variables (walkability, opportunity, and collective efficacy), the Multivariate Clustering tool, one

of the spatial statistics tools in ArcGIS Pro 2.7, was used to explore whether any clusters exist based on the three variables together (Figure 29). The results show two clusters of red and blue. The red cluster shows places where the expert overall scores were higher than overall local scores. Downtown Austin consistently shows higher expert scores than local scores.

In addition to multivariate clustering, Optimized Hotspot Analysis was used to explore whether there are any clusters based on the three variables together. This tool works based on only one variable. Therefore, another field was created with a sum of the three difference scores to obtain an overall difference score to use this tool. Then, an Optimized Hotspot Analysis was run to detect any clusters in the data.

The results showed a highly significant hot spot (99%) around Austin downtown that extends to some East and Northwest Austin neighborhoods. These are areas where overall expert scores were higher than local scores. A few highly significant cold spots (99%) were found in far Northwest and South Austin neighborhoods. In these areas, local scores were higher than expert scores. Overall, both clustering methods show similar results. Especially, both methods show a clear cluster in Austin Downtown areas with expert scores being higher than local scores.

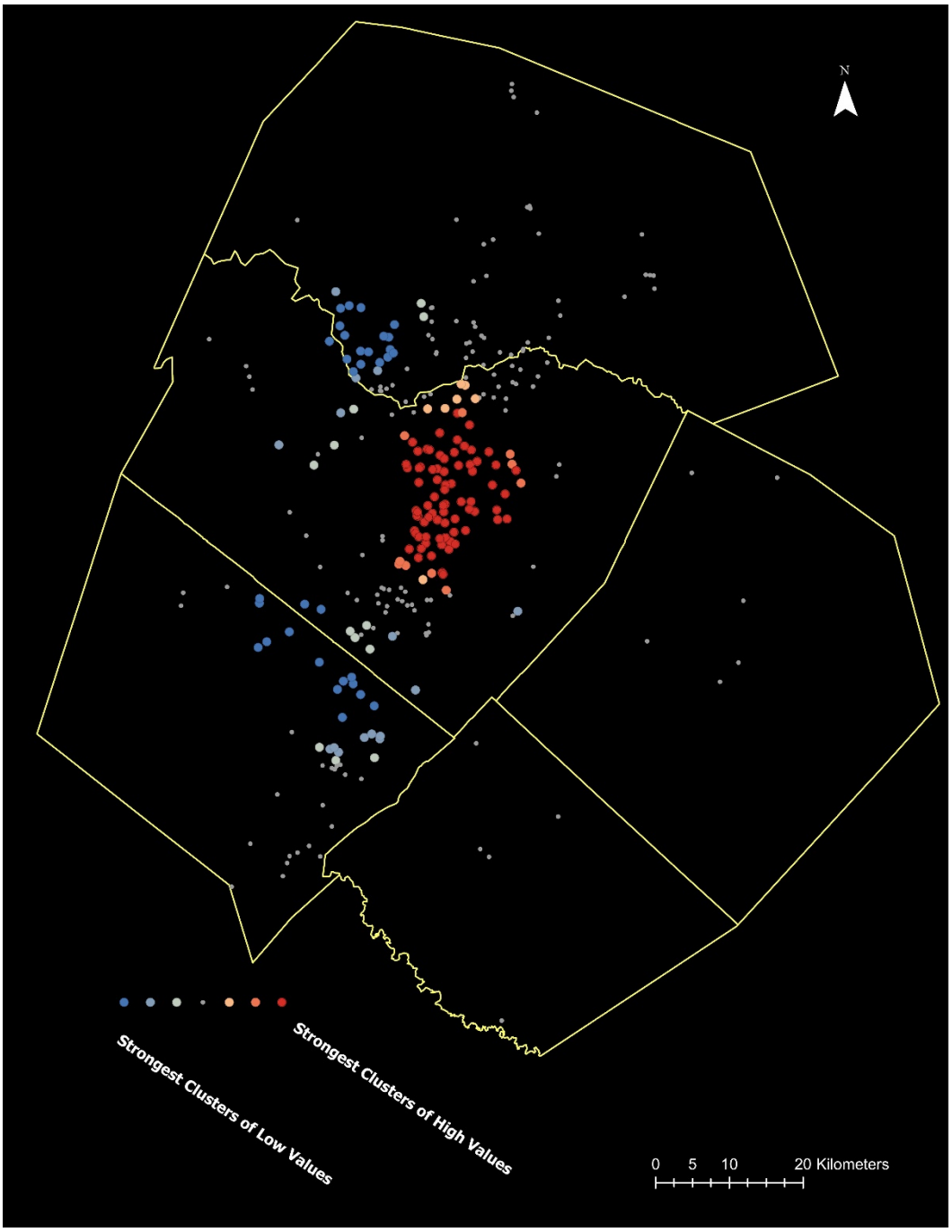

Figure 29. Overall Optimized Hotspot Analysis. This analysis is based on walkability, opportunity, collective efficacy scores.

Interview Results

The purpose of the interviews was to learn more about the parental perception of neighborhood child-friendliness regarding walkability, access to opportunity, and collective efficacy. This information will help answer RQ3 that asks about the qualitative differences between expert-derived models of Austin's child-friendliness landscape characteristics and parents' perceptions and experiences within the study area?

Seven parents volunteered to participate in the follow-up interview. All seven parents live in Austin, Texas. Figure 30 shows the approximate location of participants' residents, which were geocoded based on their residence's closest intersection. Table 12 presents the sociodemographic information about each participant.

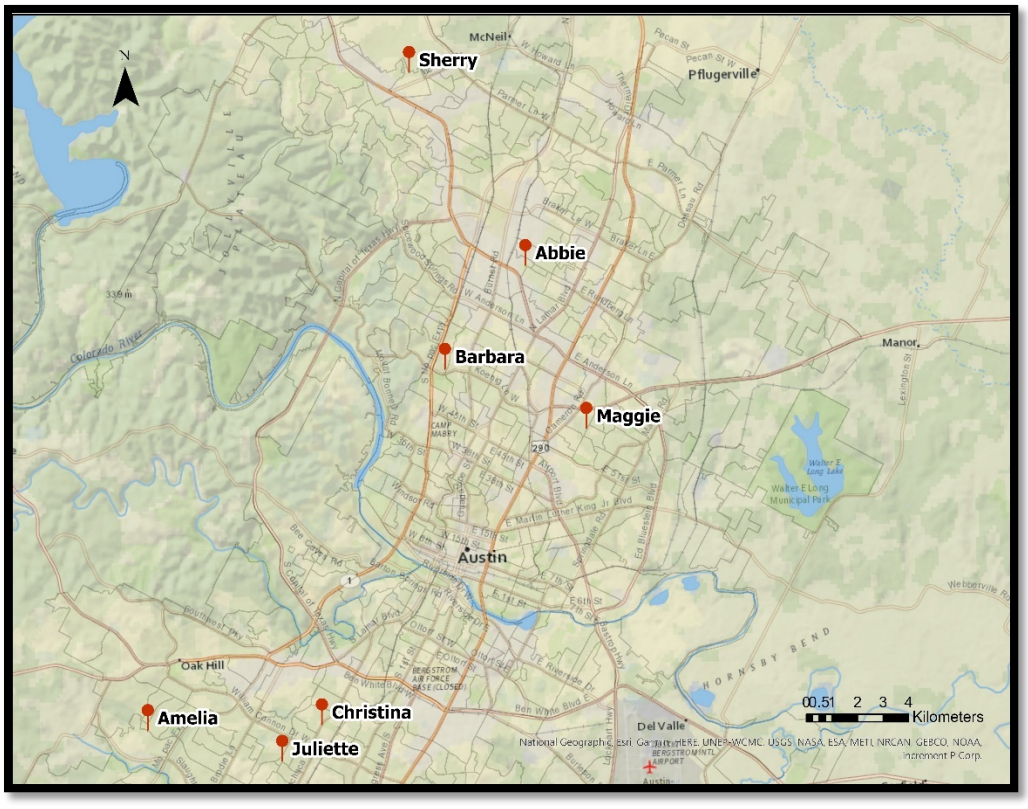

Figure 30. Interviewees' locations in AMSA.

Table 12. Socioeconomic characteristics of the interview participants.

Interviewees	Abbie	Amelia	Barbara	Christina	Juliette	Maggie	Sherry
Age	20	40	42	44	33	40	48
Gender	Female	Female	Female	Female	Female	Female	Female
Education Level	High school graduate	Post-graduate masters or professional degree	Post-graduate masters or professional degree	Post-graduate masters or professional degree	Post-graduate masters or professional degree	Post-graduate masters or professional degree	Bachelor ’s degree
Race/Ethnicity	Hispanic	Other (Latina)	White	White	White	White	Other (mixed)
Annual Household Income	Prefer not to say	$80,000 +	$80,000 +	$50,000 - $79,999	$80,000 +	$80,000 +	Prefer not to say
Marital Status	Single	Married	Married	Married	Married	Married	Decline to answer
Years lived in Austin	20	10+	7	30+	30+	20	30
Years lived in current neighborhood	4 months	3- 5	7	16	8	10	13

The interviewees' names were changed to maximize confidentiality. The results are presented separately and categorized based on the three aspects of neighborhood child-friendliness (walkability, access to opportunity, and collective efficacy) examined by this research. For facilitating the comparison of expert and local knowledge based on the interviews, the following maps show the Walk Score, Child Opportunity scores, and Concentrated Disadvantage index (the three expert indices previously examined) for the participants' approximate locations (Figures 31 -33).

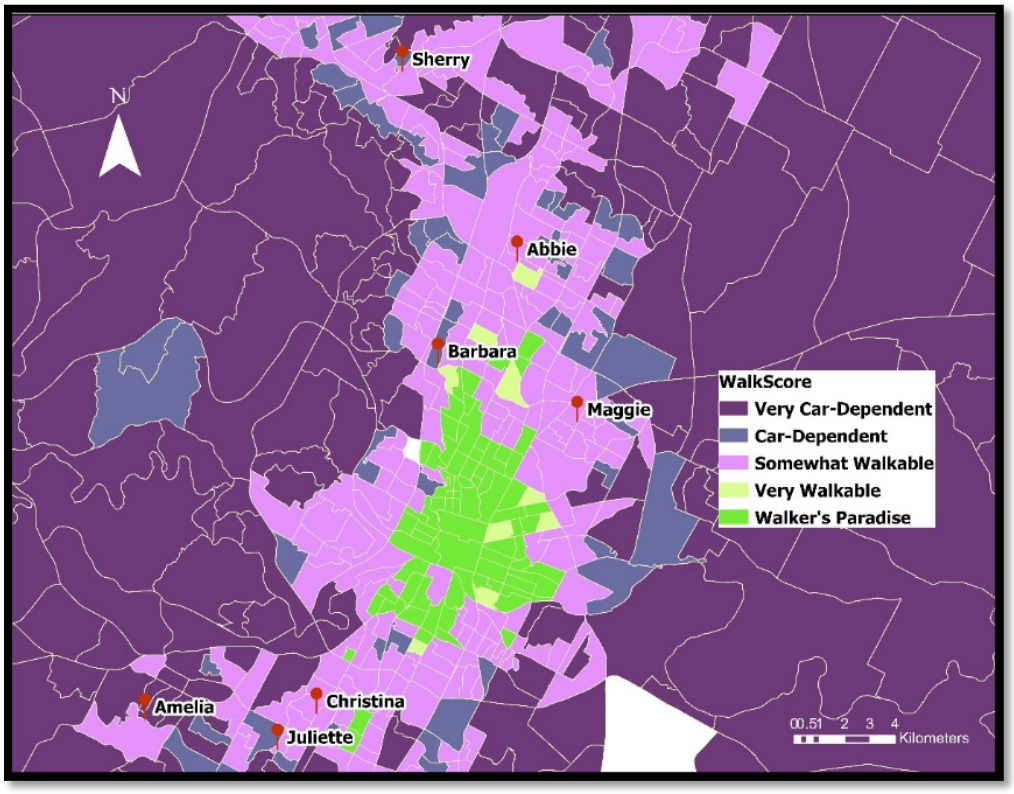

Figure 31. Walk Scores of Interviewees' neighborhoods in AMSA

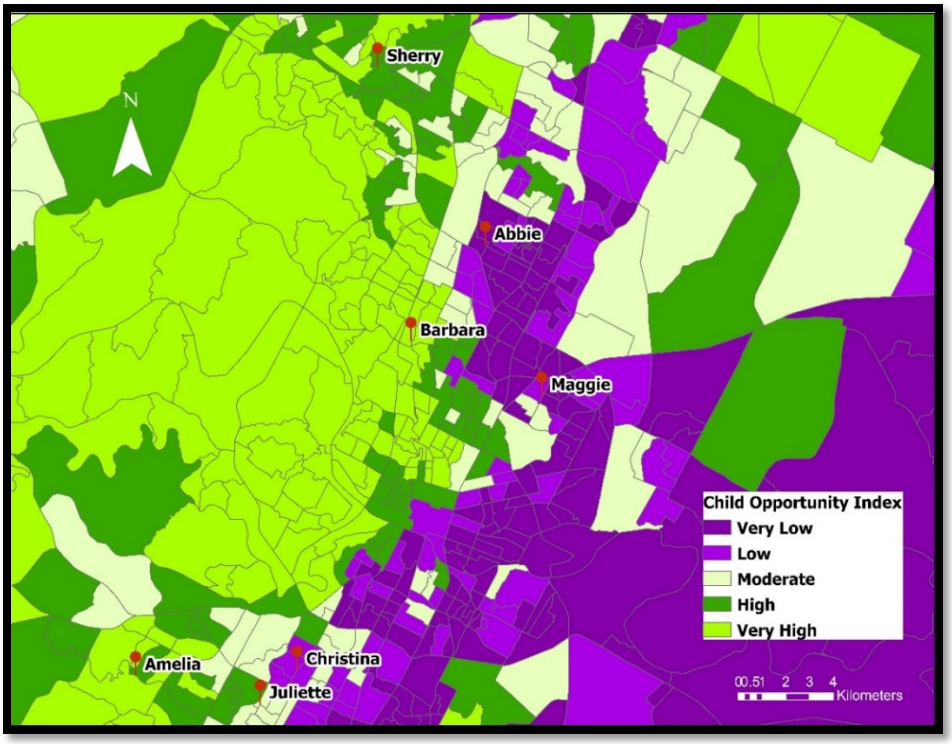

Figure 32. Child Opportunity Index of Interviewees' neighborhoods in AMSA.

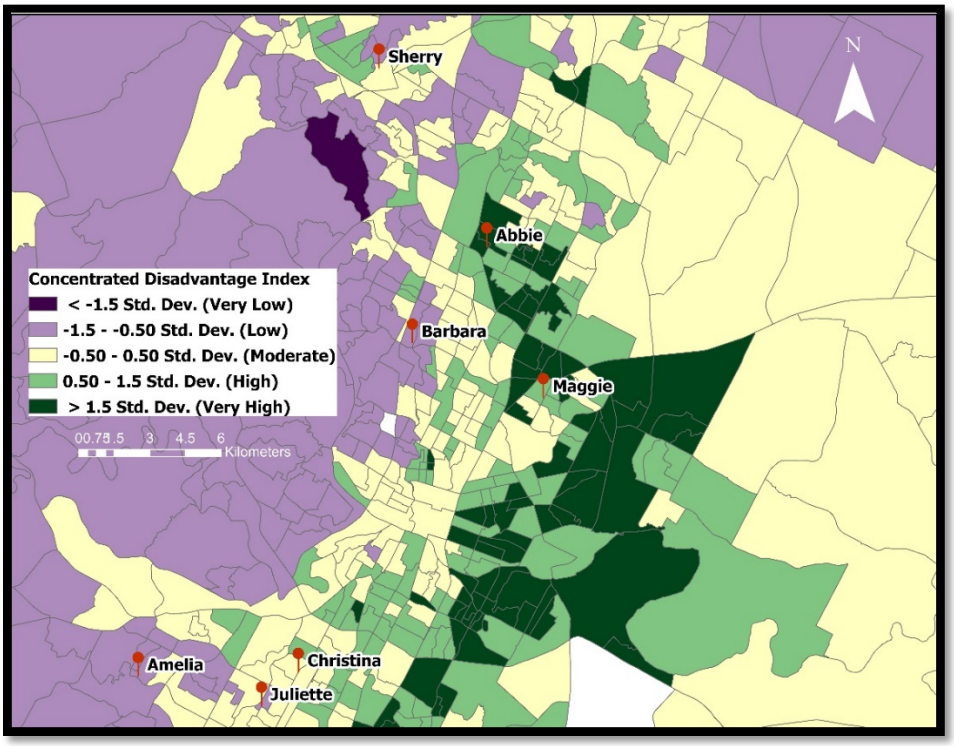

Figure 33. Concentrated Disadvantage index Interviewees' neighborhoods in AMSA.

Interviewee 1: Abbie

Abbie is a 20-year-old single mother who has lived all her life in Austin but recently moved to her new neighborhood (4 months) in North Austin. She has an almost five-year-old son and goes to Padron elementary school, located less than half a mile from her residence. Her son commutes to school always with a parent or guardian. They travel the distance to school on foot, by car or city bus. Their household is made of her, her son, and another adult (not a family member).

According to expert indices, her neighborhood was somewhat walkable, with very low access to opportunity and a very high concentrated disadvantage. To compare the expert view with Abbie's perception of her neighborhood, she was asked to elaborate on her answers to the survey questions regarding walkability, access to opportunity, and collective efficacy. Figure 34 is a code cloud based on the topics that Abbie talked about during the interview. Figure 35 shows a portrait of the interview transcript, and colors show which codes are used. This visual shows that Abbie's most important topic was walkability (Blue), followed by collective efficacy or the social environment (Red) of her neighborhood. Abbie did not talk much about access to opportunity, and that may be because she was new to the neighborhood since she moved there about four months before the interview. Most importantly, as she mentioned several times, she does not "feel comfortable enough to explore" within her neighborhood due to the unsafe social environment.

Figure 34. Code cloud based on Abbie's interview.

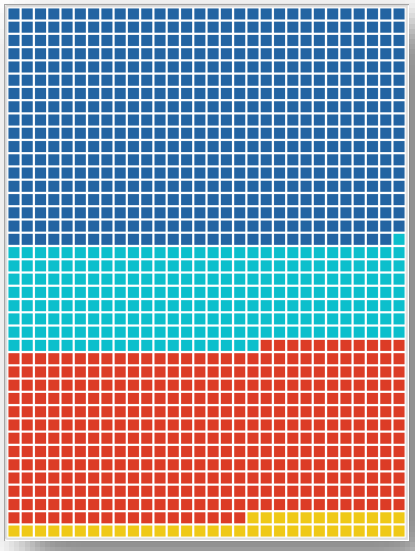

Figure 35. Code portrait of Abbie's interview. Blue is used for Walkability, turquoise for Further Concerns, Red for Collective Efficacy, and yellow for Opportunity codes.

Walkability

When Abbie was asked about what she thinks about walking in her neighborhood, her first answer was: “I really do not feel comfortable or safe, especially at night. There are like many people that are outside that just in general do not show any respect for themselves or respect for others. I do take the bus. The bus is right in front of my

apartments. I really do not feel comfortable just waiting for the bus. So, the people that are in the area, so I do not, I really don't feel safe in my area. She even says that if her son were older, she would have preferred to walk with him. She gave an example of a situation where she and her son felt unsafe and uncomfortable, explaining: “I had an accident like a few days ago where we were at the bus stop. And then out of nowhere, a couple of guys wanted to fight each other. And my son got so scared, and he was like, what's happening, what is happening. he even suggested for me to call the cops.”

Other than this problem, she said that physically walking within the neighborhood is fine. However, Abbie reports that her neighborhood is not safe for driving because there are always cars blocking the view and cause uncommon traffic. “There have been a few accidents because cars are blocking the view.

Opportunity

Abbie stated that there are several opportunities (two parks, a mall, laundromat, stores, etc.) within the neighborhood where she lives, but she does not feel comfortable exploring because of social hazards. For example, she mentioned: “there's this place called Caritas of Austin, but I don't know if it's a recreational group. I've seen a lot of people go there, but as I said, I don't, I don't feel comfortable enough to explore, you know.”

Collective Efficacy

Abbie mentioned several times that her neighborhood did not have a safe social environment when she talked about walkability and access to opportunity. When she was asked whether she trust any of her neighbors, she said: “socially, like with my neighbors, I really do not know them; not the upstairs or the next-door neighbors. Well, sometimes

we pass by each other, and they say hi or stuff like that." Abbie mentioned that she used to be in contact with a former coworker who "is a mom too," but she lives in another area of the apartment and has a few problems, so they do not meet as often anymore.

Abbie reported that her neighborhood experiences some instability as many neighbors move in and out frequently. She did not complain about the physical structures of the complex where she lives. However, she was worried about the social environment and specifically mentioned that she does not trust her neighbors. She made an example of a neighbor who seemed to have good intentions, but Abbie preferred to stay cautious mostly because she is a mother. Here is how she explained the situation: "there was one of the neighbors that he lives in another building. He came in, and he told me that he was going around the apartments to let people know that he was part of an organization where they help people. Like if they didn't have food or clothes, he was able to help us, like get in contact with the group. He gave me his phone number, and he gave me his building and apartment number. And he said, if you need anything or just want to talk, I'm here for y'all. But like I said, I think before moving on more because of how the neighbor is really like; it's not a good neighborhood. The apartments are good, but in general, I think the neighborhood overlaps the good people."

Other Concerns or Requests

Abbie was asked whether she had any other concerns or wanted to see any features added or removed from her neighborhood. Once more, she expressed her concern about social safety thus asked for more neighborhood patrols. She mentioned that it is sometimes frustrating to see "cops pass by, and they don't do anything about the people that are just doing whatever they want; it's a struggle for me. It's clear that they're

breaking the law, but there's nothing done about it.” Also, Abbie asked for enforcing the parking rules to reduce the risk of accidents as many cars park in places where they block other drivers' views. Finally, she added that improving the street lighting and adding some crosswalks would be helpful.

Interviewee 2: Amelia

Amelia (age range: 35-45) has lived in Austin for more than ten years and in her current neighborhood in Southwest Austin for more than three years. She is married, her household is 5, and she has two children in elementary school. Her children are 8- and 10-year-old and are in 2nd and 4th grade, respectively. They go to Mills elementary school, which is located less than a mile from their residence. Her children are not allowed to travel in their neighborhood alone or with friends. So, they are always accompanied by a parent who drives or bikes with them to school.

According to expert indices, her neighborhood was somewhat walkable, with very high access to opportunity and low concentrated disadvantage. To compare the expert view with Barbara’s perception of her neighborhood, she was asked to elaborate on her answers to the survey questions regarding walkability, access to opportunity, and collective efficacy. Figure 36 is a code cloud based on the topics that Barbara talked about during the interview. Figure 37 shows a portrait of the interview transcript, and colors show which codes are used.

Figure 36. Code cloud based on Amelia's interview.

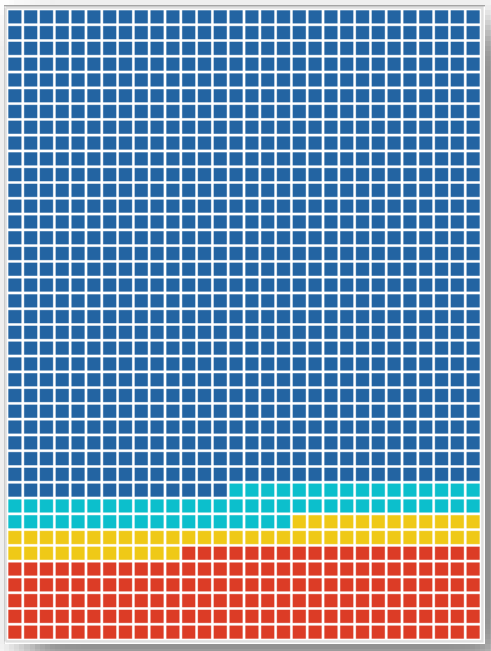

Figure 37. Code portrait of Amelia's interview. Blue is used for Walkability, turquoise for Further Concerns, Red for Collective Efficacy, and yellow for Opportunity codes.

Walkability

Amelia's neighborhood is, to some extent, walkable. This is in line with the expert index. She reported that the trees provide lots of shade and the sidewalks in the neighborhood are well-maintained thus, she and her children can easily go for a walk.

However, there are not many amenities within walking distance, and to reach those amenities that are close, they have to pass high traffic streets. Therefore, she believes that her children are still very young to travel on their own. When her children get a little older, like her older daughter, who goes to middle school, they may be allowed to walk alone or with friends.

Opportunity

Amelia reported diverse opportunities, such as a park, dance class, pool, grocery stores, etc. However, only the park is within walking distance. She said it would be possible to walk to the grocery store as it is not that far, but there a few high traffic streets on the way.

Collective Efficacy

Amelia thinks that the social environment of her neighborhood is acceptable, but she does not trust many neighbors within their neighborhood. “the problem is that there is this neighborhood app Next Door so, you actually know what the neighbors are thinking, and that makes you wonder about the sanity of your neighbors.” However, she has a close relationship with her immediate neighbors and trusts them enough to ask them to watch their children in an emergency. She continued by saying that there are in total four neighbors whom they talk to, and not many neighbors have children in elementary school.

Other Concerns or Requests

Amelia would like to see speed limit signs added, especially close to her

children's school. She likes to see more amenities, but at the same time, she is aware that to add more amenities, "they would have to fundamentally change the nature of this neighborhood." Therefore, at the current stage, she believes that their neighborhood offers enough amenities for her children. However, when they get older (teenage age), there might not be many amenities that fit their age.

Interviewee 3: Barbara

Barbara is a 42-year-old mother who has lived in Austin and her current neighborhood in West Austin for seven years. She is married and has two children in elementary school. Her children are 8- and 10-year-old and are in 2nd and 4th grade, respectively. They go to Gullett elementary school, which is located half a mile from their residence. Their parents drive or sometimes bike with them to school. Also, they are allowed to walk with friends to school. Their household is 4.

According to expert indices, her neighborhood was ranked as car-dependent, with very high access to opportunity and low concentrated disadvantage. To compare the expert view with Barbara's perception of her neighborhood, she was asked to elaborate on her answers to the survey questions regarding walkability, access to opportunity, and collective efficacy. Figure 38 is a code cloud based on the topics that Barbara talked about during the interview. Figure 39 shows a portrait of the interview transcript, and colors show which codes are used.

Figure 38. Code cloud based on Barbara's interview.

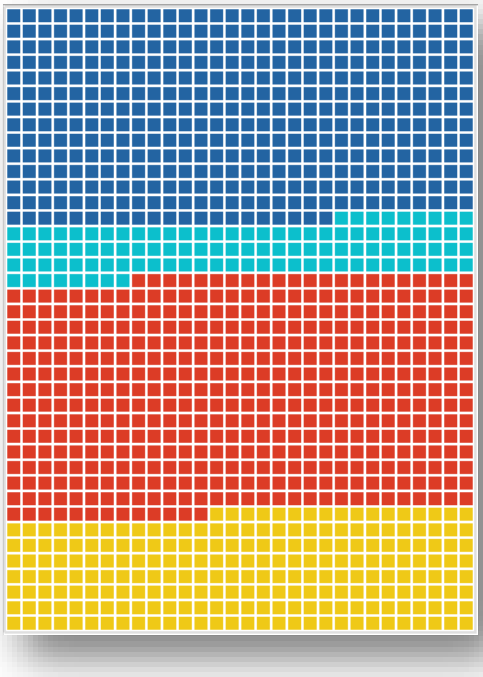

Figure 39. Code portrait of Barbara's interview. Blue is used for Walkability, turquoise for Further Concerns, Red for Collective Efficacy, and yellow for Opportunity codes.

Walkability

Barbara reported that her neighborhood is walkable because it has a safe social environment, good sidewalks, and traffic control signs (especially the stop signs). Also, her neighborhood has good crosswalks to "cross the busier street like Shoal Creek; you

can push the little blinking light. So that would stop car traffic." She only criticized the sidewalks, which "are not always in good shape because of the trees. We have a lot of oak trees. I think that pops them up a bit." Also, she mentions that most of the sidewalks "are not even, and there are parts of the neighborhood that do not have sidewalks. So, depending upon where you are going, you might have to walk in the street for a little while."

Opportunity

Barbara reported a pool that belongs to the City, a tennis court and a basketball court in their neighborhood. "We have Northwest park; it is not a huge park." She mentioned that the park has plenty of amenities but also needs improvements. "The playground is pretty small and caters to small children, which is great if you have young younger ones, but once they get past the age of four, maybe five, there is not that much for them to do there.

Collective Efficacy

Barbara has a positive opinion about the social environment of their neighborhood. She believes their neighborhood is safe, and they can count on neighbors on having an eye on their children when they are playing outside: "our neighborhood has a ton of young children, and people are always out. Even if they do not have kids, they are always out in their front yard doing work, so there are always people around. So, we feel very safe." She added that her children socialize with friends riding bikes together, but they mostly play indoors in their house or friend's house. As a family, they have some close friends in their neighborhood, and they interact mostly with their immediate

neighbors. However, they know many people in the neighborhood, and they “share sometimes picking kids up from school, like if you're stuck at an appointment or something, I know I can always contact a friend in the neighborhood to help out in any way regarding the kids and vice versa.

Other Concerns or Requests

Barbara would like to see a few features added to their neighborhood parks to make it more appealing to older children: “I think having that do like they did with the park in Rosedale, I can't remember the name of that park, but they added two more features, and they're like climbing and that appeal to an older audience as well” or “make it like some of the parks like Cedar Park that have, like slides and water features and look a little river. I know that's expensive, but that would be a dream if they could.” She also wants to see a new pool as the other one in the neighborhood is “super old,” as she said.

Interviewee 4: Christina

Christina is a 44-year-old mother who has lived in Austin since 1975 (on and off). She has lived in her current neighborhood in South Austin for 16 years (although she traveled a few times for work and study). She is married and has three children in elementary school and one older child who lives in their household part-time. Her children in elementary school are 3,5, and 6-year-old and are in Pre-K3, Pre-K4, and K grades, respectively. They go to Cunningham elementary school, which is located half a mile from their residence. Their parents drive them or sometimes walk with them to school. Their household size is five, except when the older child joins them that it becomes six.

According to expert indices, her neighborhood was somewhat walkable, with low access to opportunity and moderately concentrated disadvantage. To compare the expert view with Christina's perception of her neighborhood, she was asked to elaborate on her answers to the survey questions regarding walkability, access to opportunity, and collective efficacy. Figure 40 is a code cloud based on the topics that Christina talked about during the interview. Figure 41 shows a portrait of the interview transcript, and colors show which codes are used.

Figure 40. Code cloud based on Christina's interview.

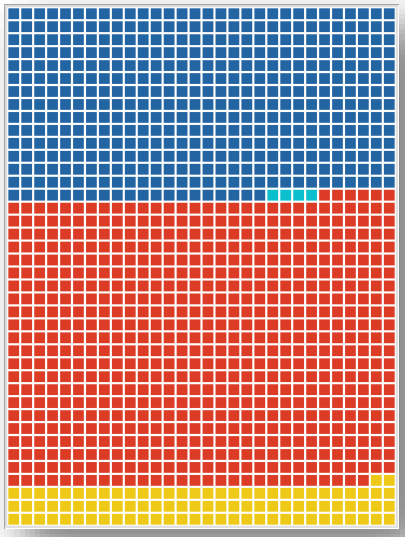

Figure 41. Code portrait of Christina's interview. Blue is used for Walkability, turquoise for Further Concerns, Red for Collective Efficacy, and yellow for Opportunity codes.

Walkability

Christina stated that their neighborhood is unsafe for pedestrians for two reasons: incomplete and discontinued sidewalks and high traffic roads. Despite this situation, she and her three children often walk to school in the morning. “In order to leave our neighborhood, we have to walk on Manchaca road and then cross it to get to the school.” She mentions that this road is often very busy with a high risk of an accident. Indeed, she

and her children witnessed a fatal accident when one day “a lady was crossing at not an approved crosswalk and stepped in front of like a bus and then actually one of the teachers hit her.” Christina’s children were highly impacted by this accident, so they “didn't walk for a long time after that.” She mentioned that even driving down that road was not easy for them as it reminded them of the tragic accident.

Christina added that to reach the school, they have to walk in front of a charter and a private school where they risked a few times to be hit by parents driving into the school’s parking lots. She took action by writing to the principal and explaining the situation. In addition, she wrote a letter to the city regarding the crosswalk that they need to cross to reach the school. Her concern regarding the crosswalk was that the lights turn green for cars when pedestrians are still on the crosswalk. The City “changed the timing, a little bit.” But during the winter break, “it went back to the old timing, and then people complained again. And I think that they fixed it again.”

Christina also talked about the speeding problem in their neighborhood as well. This issue seems to be mostly caused by the lack of stop signs, as she explained. She made an example of a special needs child who was almost hit by a car due to the latter problem. As a result of all these issues, Christina does not allow her children to walk to school alone. They always need to be accompanied by an adult. Only her older child, who is middle-school-age, is allowed to sometimes walk to school alone.

Opportunity

When asked about access to opportunity, Christina mentioned a “very nice park within walking distance (less than a mile), and it's great. But the only way you can get there is with no sidewalks.” Another park, “a City park, is located right next to the

neighborhood, and with that City park, we have like the playground grilling. (C, Pos. 77), she said. Christina's neighborhood also has some sports fields (tennis, basketball, and baseball) and two playgrounds that they can access through a high school and an elementary school (they are open to the public). Other sporting youth activities are also within walking distance, like soccer facilities. They have two pools: one is a community pool that is not free; another one is a City pool where they pay but can take swimming classes. Christina likes the City pool better.

Collective Efficacy

Christina started talking about their neighborhood's social environment by saying, "the neighborhood has changed significantly from when I first bought this house like 15 years ago. I think people were a little more friendly with each other. But throughout the years, people just really mind their own business and don't talk to each other much." This might be because "the people that have been here for years that I know are elderly or have passed away. We have new people who move in, and a lot of the people who have moved in have actually been from out of state, usually from California. They don't send their children to the local neighborhood schools." Christina talked about the socioeconomic divide among the neighbors. For example, "the houses that I can see like for my front door, there is four families with kids, and none of them send their kids to the local public school. Some of them are wealthier than others. So, they may be sending them to some big private schools."

Christina does not trust many people in their neighborhood, only "an older neighbor whose husband died, and we've known them for 15 years." She also mentioned lack of time as one reason she could not meet and know new neighbors. Christina

explained that their family, but mostly her older child, who is in 1st grade, has been emotionally impacted by Covid-19 as they do not go pretty much anywhere and do not meet anybody. However, on the positive side, Christina's children improved their reading and technology use by staying home. Another positive aspect of this situation was using social networks such as Facebook to socialize "even with people that we might not have socialized with before in the community." For example, even children who were not close friends are virtually "in each other's homes where they probably would not have happened without." Also, people in their neighborhood seem to be friendlier in greeting each other when they are out for a walk, "even people that would never talk to you before."

Other Concerns or Requests

Although Christina would like to see more complete and continuous sidewalks in their neighborhood, she seemed to be very concerned about the City's plans for improving sidewalks, especially because this plan involves removing part of her back yard. Also, she was disappointed in the City's lack of transparency about this plan: "the City has been very secretive about their Manchaca quarter plan, and they just sent like a tiny little postcard mailer that they were having a meeting." Indeed, "I was the only person representing my area of the neighborhood. In this meeting, there were developers from North Carolina." Also, Christina was irritated mostly because the City already voted and told her that "we've already decided on this proposal and we're going to come in as eminent domain" to get a portion of your property "up to 20 feet from the curb." She continued by saying that "they have effectively rendered our access to that property not valid." She claimed that the city was not even clear about how much they would have

paid her for her property.

Christina continued by explaining that "I think sidewalks are great; I have kids.; but they are going to come to take my property and not really inform us except by some tiny little postcard." She said that they were in the process of building a deck and a garage in the back of their property because they do not have a garage. "now we have basically a big storage that we can't really drive into."

In addition to this issue, Christina reported that their neighborhood needs better lighting. Also, many historical trees cover some parts of the streets, she said. "We had a new neighbor, and we saw that they cut all the trees down, but they got fined by the city […] so, some people have no trees, and then some people have like great grandiose assists historical trees and up."

Interviewee 5: Juliette

Juliette is a 33 mother of two and has lived in Austin all life and about eight years in her current neighborhood in South Austin for more than three years. She is married, and her household size is 4. Her children are 2- and 8-year-old and are in Pre-K and 2nd grade, respectively. They go to Cunningham elementary school, which is located 2 miles from their residence. Her older child is allowed to travel within their neighborhood a distance of 10 minutes alone and 15 minutes with friends.

According to expert indices, her neighborhood was somewhat walkable, with moderate access to opportunity and low concentrated disadvantage. To compare the expert view with Juliette's perception of her neighborhood, she was asked to elaborate on her answers to the survey questions regarding walkability, access to opportunity, and collective efficacy. Figure 42 is a code cloud based on the topics that Barbara talked

about during the interview. Figure 43 shows a portrait of the interview transcript, and colors show which codes are used.

Figure 42. Code cloud based on Juliette's interview.

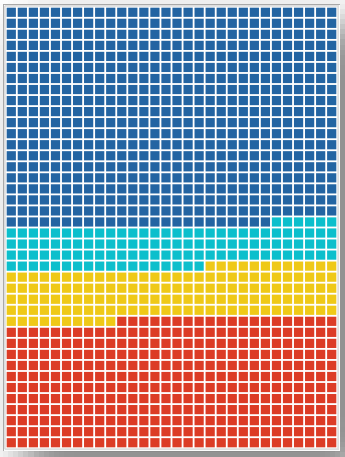

Figure 43. Code portrait of Juliette's interview. Blue is used for Walkability, turquoise for Further Concerns, Red for Collective Efficacy, and yellow for Opportunity codes.

Walkability

Juliette's family leaves about 2 miles from school, and in addition to being distant, walking to school involves crossing a major intersection. So, one of the parents drives their children to school. Also, there are places in their neighborhood "where there's either no sidewalk or it's not really accessible because of vegetation." Therefore, although her older child can travel short distances alone or with friends, Juliette does not feel

comfortable leaving her children unsupervised walking in their neighborhood. She is concerned about potential social and physical hazards. Also, she mentioned that not many children play or bike in their neighborhood so, she is not sure "how strong a culture there is of like, hey, we all kind of mutually look after each other's children versus there's an unintended child on a bicycle." Finally, she mentioned that "definitely as my kids get older, they'll probably have a larger radius to walk alone." In general, Juliette's perception of the walkability aspect of their neighborhood is close to what the expert index (WalkScore) shows.

Opportunity

Juliette mentioned that her neighborhood has a pocket park (no amenities, just a playground) walking away from their residence. In addition, there are a couple of other City playgrounds (short drive, ambitious walk), which have more amenities such as restrooms and water fountains, and hiking trails.

Collective Efficacy

Juliette's family is more in contact with their immediate neighbors, who also have children. She trusts a few neighbors with her children. For example, "I send the older child on like an errand to drop something off down the street to a neighbor, and I know that that mom will text me when she gets there."

Juliette believes that her relationship with neighbors has changed due to working from home during the Covid-19 period: "just because everyone's home and outdoors all the time." For example, "two doors down that I'd never seen before I met the parents; just

because normal life is so much of the like, we're commuting and going to work and, doing the right kind of things. So, that's been kind of a strange upside to this where we have met more of our neighbors and gotten more of a feel of the neighborhood."

Other Concerns or Requests

Juliette would like to see extra vegetation is removed from around the playground areas for safety reasons. She would also like to see water fountains added to the playgrounds. Another issue would be the sidewalk conditions for Juliette. She talked about a City project for improving her neighborhood's walkability, but the results of the improvements are not very satisfying to her and other neighbors. She said, "people are still driving fast and others driving fast in opposite directions in the same lane. The way cones are positioned, if you were using a bike or wheelchair or a stroller, you couldn't actually maneuver between the cones or even like a large dog. So, I love the idea because we are home all the time and spending a lot more time walking in our neighborhood, but I don't know."

Interviewee 6: Maggie

Maggie is a 40-year-old mother who has lived in Austin for more than 20 years and in her current neighborhood in East Austin for ten years. She is married, and their household size is 4. She has two children, both in elementary school. Her children are five and 9-year-old and are in K and 3rd grades, respectively. They go to Blanton elementary school, which is located about a mile from their residence. They commute to school on foot, in the car, and on the bike, but always accompanied by a parent.

According to expert indices, her neighborhood was somewhat walkable, with low

access to opportunity and high concentrated disadvantage. To compare the expert view with Maggie's perception of her neighborhood, she was asked to elaborate on her answers to the survey questions regarding walkability, access to opportunity, and collective efficacy. Figure 44 is a code cloud based on the topics that Christina talked about during the interview. Figure 45 shows a portrait of the interview transcript, and colors show which codes are used.

Figure 44. Code cloud based on Maggie's interview.

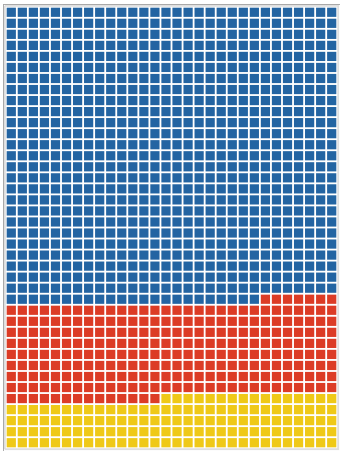

Figure 45. Code portrait of Maggie's interview. Blue is used for Walkability, turquoise for Further Concerns, Red for Collective Efficacy, and yellow for Opportunity codes.

Walkability

Maggie stated that "our neighborhood is very walkable. We did walk or bike to school last year with a parent, and the only challenge/reason why I would never let my

kids do it without me is that we have to cross a fairly major road. We were able to get a crosswalk. But cars don't stop at the crosswalk, so we end up waiting maybe three to five minutes every day trying to get across that road. That's a pain." She continued, "aside from that, all the other neighborhood streets are walkable. We don't have sidewalks, but we're starting to get some on some streets. […] Our street has no sidewalks at all."

Maggie mentioned that even some of the streets that have sidewalks are not safe. For example, "the main street has a sidewalk, which is nice, but there are so many car crashes and things that even with the sidewalk on that street we choose to not walk on that sidewalk." She said that they walk mainly on the streets with a sidewalk which makes the school path much longer than what it could be if all of their streets had sidewalks.

The other main issue for Maggie is speeding: "it's really bad, and there's like a bump outside of our house that I guess teenagers will deliberately speed up to try to get air. So, we hear a lot of squealing, and we just don't play in the front yard because of that. So definitely when it comes to walking on a road without a sidewalk and in hearing speeding cars coming, we just end up walking in people's lawns a lot."

Opportunity

Maggie mentioned that several opportunities, such as a pool, a mall, dance class, and a restaurant, are allocated fairly close to her residence. She also talked about a very nice park within walking distance from their residence. However, due to "a very large homeless population," people use it less, especially after a school field trip during which "one of the teachers was attacked and yelled at. And so now the kids are not even doing their field trips there. They're going to other neighborhoods." She continued by

explaining: “I'm very compassionate. I'm not saying that they shouldn't be able to be there, but it's gotten to a point where, in general, I've noticed a lot of us using the park less and less just because of that kind of uncertainty there. Even with sending my child to go to the bathroom, there is an issue because there are people that are always in it.”

Collective Efficacy

Maggie stated that there are many families with children the same age as her children in their neighborhood. Also, they met many families through school and then wound out that they live close. So, in general, Maggie’s family feels safe and connected. She said the problem is that “I don't have enough time, it's not that there aren't enough people I'd like to see. We have lots of people that we'd like to spend more time within our neighborhood, but it's just a matter of getting the time to make it happen.” Maggie pointed out that there is one neighbor across the street with whom they are very close, and they can count on each other: “my kids know they could always go bang on their door.”

In conclusion, Maggie mentioned that the crime rates are high in her neighborhood, so “I don’t feel comfortable letting my kids do the things I did as a kid in my neighborhood. I would not let them ride their bikes around wherever they want. We do have a lot of crime; it's very urban; we're right in the center. But at the same time, I don't feel fearful living here. It's just a different day and age for them.”

Other Concerns or Requests

For Maggie, sidewalks are the most important thing to see added to their neighborhood. In addition, she would like her neighborhood to have some traffic calming

measures and crosswalks for pedestrians. Maggie and her neighbors tried to talk to the City regarding the speeding problem in their neighborhood. Indeed, “I actually had the city did a speed survey, and they found that there was a lot of speeding on our street, but our residential street speed limit is 30, which is really fast for such a narrow street. I think just recently reduced it to 25, so that was positive.” However, the speeding survey showed that “our street had more people speeding at a higher percentage than a neighbor street. But because the other street had a 25 mile per hour speed limit. They got speed bumps, and we didn't qualify because ours was 30, and they're the exact same type of street. That was really frustrating.”

Interviewee 7: Sherry

Sherry is a 48-year-old single mother who has lived in Austin for about 30 years and in her current neighborhood in far North Austin (in Williamson County) for 13 years. Her household size is 6, and she has three children, who are 5, 6, and 7-year-old and are in K, 1st, and 2nd grade, respectively. Her 5- and 7-year-old go to Pond Springs elementary school, and her 6-year-old goes to Live Oak elementary school. The schools are about 2 miles from their residence. Children are driven to school.

According to expert indices, her neighborhood was somewhat walkable, with high access to opportunity and moderate concentrated disadvantage. To compare the expert view with Christina’s perception of her neighborhood, she was asked to elaborate on her answers to the survey questions regarding walkability, access to opportunity, and collective efficacy. Figure 46 is a code cloud based on the topics that Christina talked about during the interview. Figure 47 shows a portrait of the interview transcript, and colors show which codes are used.

Figure 46. Code cloud based on Sherry's interview.

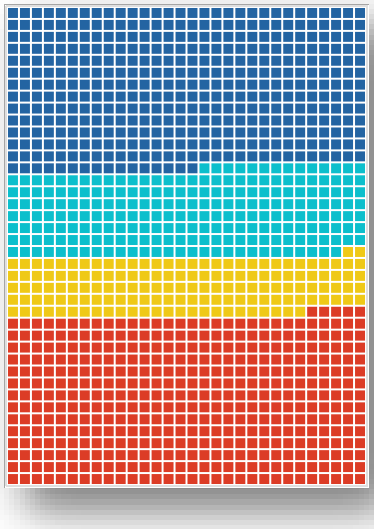

Figure 47. Code portrait of Sherry's interview. Blue is used for Walkability, turquoise for Further Concerns, Red for Collective Efficacy, and yellow for Opportunity codes.

Walkability

Sherry started to take about the walkability of their neighborhood by saying: "well, things may have changed from when I took that survey due to some activity that took place in the United States of America and being an African American mother, single mother of black sons, I feel very uneasy for my children to walk in the neighborhood or go somewhere without me. I feel very uneasy." Aside from this issue, she mentioned that walking within their neighborhood is safe traffic-wise. However, the neighborhood is surrounded by some major streets, which makes those areas less safe.

Opportunity

Sherry reported that their neighborhood is close to a series of diverse amenities, including a recreation center, pool, parks, trails, and skate land. "We were so close to everything […] We have two parks, maybe three parks in this area and my children did have access to those. They had pool cards, and then we also have the YMCA, the Northwest YMCA, right down the street. So, the children had access to that as well." She mentioned that currently, they do not do any of these activities due to Covid-19.

Collective Efficacy

Sherry's immediate neighborhood is a little community that consists of a few families that live on the same street. There are many children in their community. Sherry seemed to feel good about her neighborhood's social environment and her relationship with their immediate neighbors. She said: "on my street, we are very close-knit. It's about seven or ten houses. We're really kind of close with one another. We sit outside; our kids go to colleges together. Our kids went to high school together, so yeah, we sit outside;

even with COVID, we will sit outside and discuss things. We'll just social distance."

Other Concerns or Requests

Sherry's main concern was about the Apple company opening a second campus close to their neighborhood area. She was concerned that this change would transform their neighborhood's structure, making it more of an "urban" area with higher traffic. She was worried about the safety of many children in their neighborhood who commute alone.

In addition, sherry would like to see speed limits and speed bumps in some neighborhood streets. "I would just like some speed bumps on the main streets, like Dallas to my Mayo. […] We do have a lot of young children; once school starts back, we have children walking to school that are first, second, third graders by themselves. I would like for this community to take a look at the speed and either put speed bumps or something to kind of slow it down for the children's safety."

Overall coding schema

Figure 48 shows an overall picture of the code matrix used to code the interviews. The main codes are walkability, opportunity, collective efficacy, and further concerns, and then there are subcodes for each category. The size of the squares shows the usage of the code within the analysis. Walkability is the most coded topic as it turned out to be one of the most important aspects of neighborhood child-friendliness for parents. Figure 49 represents the codes in the shape of a code cloud. Based on both figures, the interviewees' main concern for which they do not allow their children to navigate within their neighborhoods is high traffic and unsafe driving mostly. Many mentioned that their

neighborhoods have access to diverse opportunities, but their children cannot use them independently due to parental concerns about traffic and social safety as well as cultural restrictions.

Figure 48. Code Scheme.

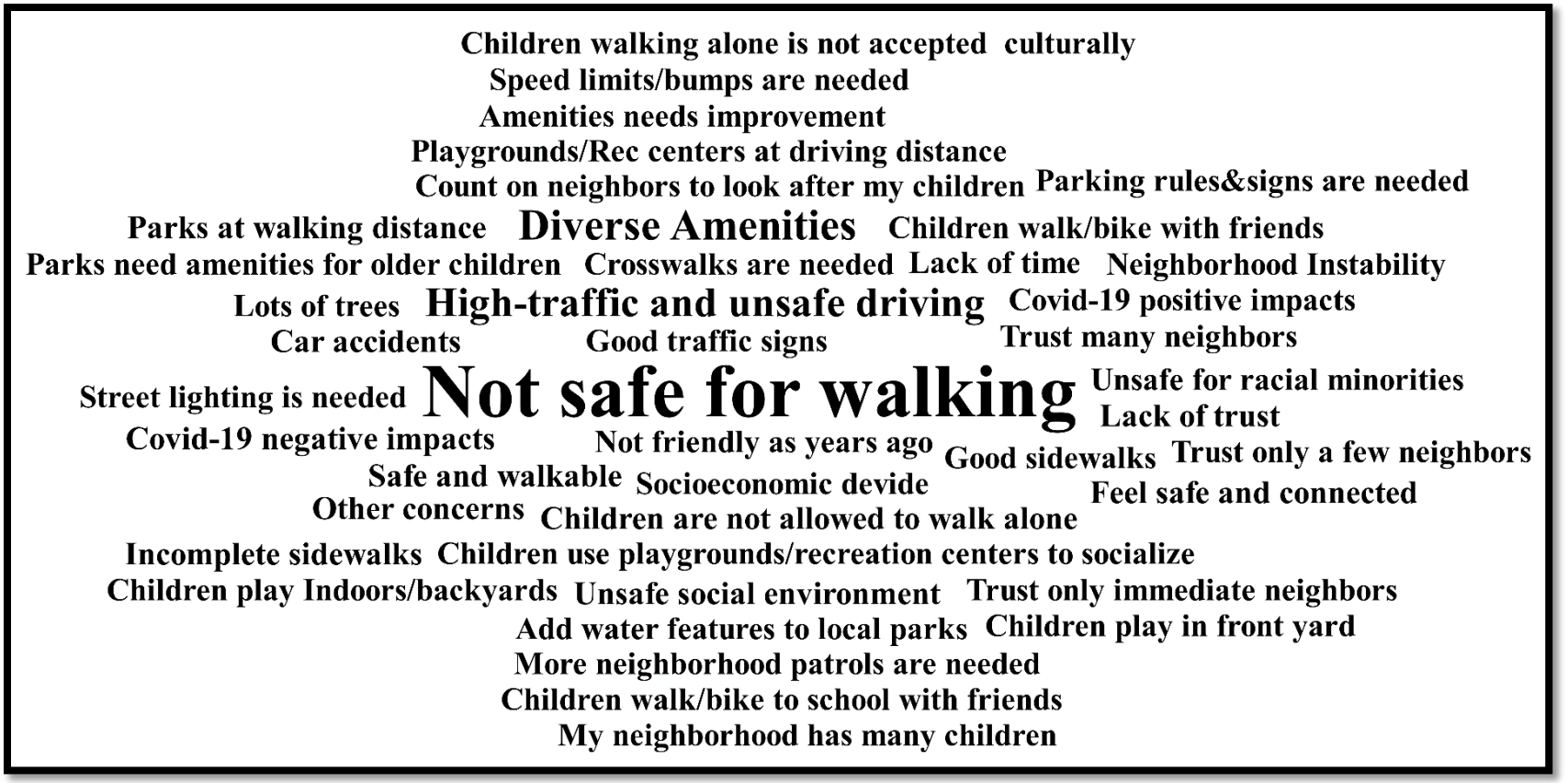

Figure 49. Code cloud of all codes.

Survey's Open-ended Questions

The survey contained two essay questions for parents to wrote what feature/s they wanted to see added or removed from their neighborhood. Figure 50 represents a word cloud of all the features that parents who took the survey would like to see added to their neighborhoods. Figure 51 shows a word cloud of features that parents would like to see removed from their neighborhoods.

Figure 50. Code cloud of the features that parents want to see added to their neighborhoods.

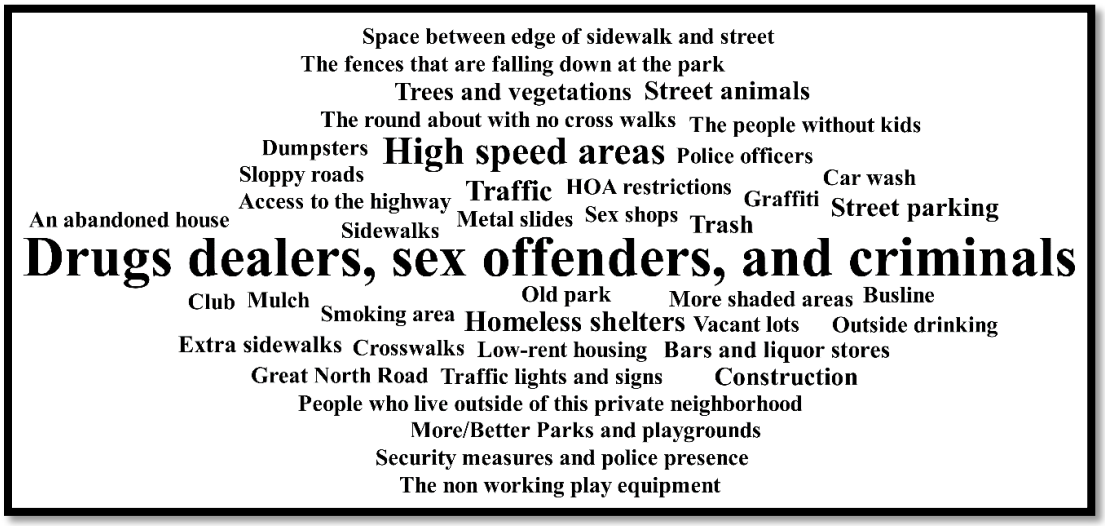

Figure 51. Code cloud of the features that parents want to see removed from their neighborhoods.

6. CONCLUSION

This dissertation research examined the differences between the expert view and local perceptions regarding neighborhood walkability, access to opportunity, and collective efficacy in Austin MSA, Texas. The expert view was represented through three indices commonly used by planners, and the local perceptions were captures through surveys and interviews from elementary school-aged parents. The first research question examines the Austin MSA landscape from the expert perspective by analyzing Walk Score, Child Opportunity Index, and Concentrated Disadvantage index at the block group level. Concentrated Disadvantage is an indicator of a neighborhood sociodemographic used to estimate the neighborhood's potential to generate collective efficacy and social support for children.

The Walk Scores analysis showed that most of the highest scores are located in Austin's urban core in Travis County and San Marcos downtown in Hays County, Texas. The urban core of Austin and, to some extent, Sam Marcos's downtown is where a great number of businesses are located, and due to their centrality, housing prices are high. Compared to other parts of the study area, which are mostly car-dependent according to Walk Score, the downtown areas contain a lower child population. Elevated real estate and housing prices and higher pollution levels and traffic are among the main factors leading families with younger children to choose to live in suburban areas rather than more urbanized neighborhoods in downtown areas.

Unlike Walk Score, Child Opportunity Index showed a distinct east-west division in the distribution of opportunity, especially in Austin, TX. Neighborhoods in East Austin showed significantly lower access to opportunity for children than neighborhoods in the

West, resulting in noticeably higher access to diverse opportunities. West of the study area, especially in Austin, is where wealthier neighborhoods are in contrast to the eastern part, where there is a higher concentration of disadvantage. Indeed, the concentrated disadvantage scores also indicated that neighborhoods in the east of the study area suffer more socioeconomic disadvantages than those in the west. The latter neighborhoods also contain a larger population of African American residents. In some of these neighborhoods, the population of children is also considerably larger than many block groups in other parts of the study area.

The second research question examined walkability, access to opportunity, and collective efficacy of the neighborhoods from parents' perspectives that represented the local view. Overall, most parents had a positive opinion about their neighborhood's walkability in terms of physical structure. However, regardless of the overall satisfaction, over half of the parents admitted that they do not allow their children to walk in their neighborhood alone. The analysis of the survey's open-ended questions and interview responses showed that concerns regarding social and traffic safety are among the main reasons for which parents do not allow their children to walk within their neighborhood independently.

The same pattern resulted in being true for access to opportunity and social, organizational aspect of the neighborhood. Most parents perceived their neighborhood to have adequate access to opportunity and generate collective efficacy for their children. However, fear of crime, cultural concern, high-speed streets, and careless drivers seem to be among the main factor preventing them from allowing the children to access those opportunities independently. When asked what other features parents preferred to see

added or removed from their neighborhoods, many showed a preference for more parks and playgrounds in general, and some asked for improvements of amenities in the existing parks. During the interviews, some parents mentioned that most of these facilities do not have adequate amenities to attract older elementary school-aged children despite having access to nice parks and playgrounds.

The third research question examined whether there were any differences between parental perceptions with expert indices and whether there were any geographic clusters where these differences were more prominent. The results showed differences in how expert indices represent the landscape with how parents of elementary-school-aged children perceive the same landscape. In some places, parents scored their neighborhood lower or higher than what expert indices showed. The cluster analysis showed some distinct clusters. For example, walkability scores differed significantly in and around Austin downtown. In these areas, parents gave a lower walkability score than the expert index (Walk Score). On the other hand, parents living in some neighborhoods in the far northwest and south Austin and along the I35 in Hays had a better perception of their neighborhoods' walkability than the expert scores. These differences indicate that expert indices often do not conform with how local communities perceive the same landscape.

Opportunity scores differed in a few block groups in the center, south, and east Austin, where local scores were better than experts scores. Regarding collective efficacy, a few clusters of differences were also identified. Parents living in the east of Austin generally had a more negative opinion regarding their neighborhood's social and organizational aspects (collective efficacy) than what showed by the concentrated disadvantage index. On the other hand, in a few smaller block group clusters on the

western side of the study area, parents gave a better collective efficacy score than the expert index.

Considering the methodological limitations of this study, including the limited number of surveys and interviews, the results cannot be considered exhaustive. More data is needed to understand the differences between expert and local knowledge within the study area. However, this study completed a set of qualitative and quantitative analyses to emphasize the need to use GIS in ways that allow the incorporation of local views into planning indices. The results of this study confirm that many expert indices lack the firsthand experiences of local communities. The only way to access these experiences is to encourage local communities' participation in participatory planning processes through adequate methods in line with each community's cultural, physical, and demographic characteristics. Although participatory planning could be challenging from various sociopolitical and economic aspects, it is the only way to reach a more democratic and inclusive process in planning neighborhoods to address the needs of all in increasingly diverse societies.

7. DISCUSSION

In view of the global efforts to make cities more "inclusive, safe, resilient and sustainable" (UN Sustainable Development Goal 11), this dissertation explored how the interplay between expert view and local knowledge can improve the planning and design of neighborhoods to make them more adequate for child use in Austin Metropolitan Statistical Area (AMSA), Texas, USA. Neighborhood child friendliness was examined from three aspects: walkability, opportunity, and the neighborhood's potential to generate collective efficacy for children. Three related professional planning indices were used as a proxy for an expert view. Parental perceptions were gathered to represent the local view as previous studies found that parental perceptions play an important role in children's use of the neighborhood environment (Hunter et al., 2020).

The analysis of neighborhood child-friendliness based on expert indices found that the most walkable neighborhoods are the ones in the downtown area where most of the businesses are located. Being more of commercial hubs, not many families with children live in these neighborhoods. Also, in places such as Austin's downtown, with property values skyrocketing, not many families with children can afford to buy or even rent. Among other reasons are elevated levels of pollution and crowdedness in these areas. Compared to these areas, the rest of the neighborhoods, mostly located in the suburbs, are predominantly car-dependent. This finding aligns with previous studies that found that property values are significantly higher in more walkable neighborhoods (Moudon and Lee, 2012; Rauterkus and Miller, 2011). This problem affects families of color the most who, due to their socioeconomic status and other problems such as gentrification and historical segregation, cannot afford to live in such neighborhoods

(Bereitschaft, 2017; Riggs, 2016).

The expert analysis of access to diverse opportunities showed a distinct difference in the spatial distribution of opportunity between the eastern and western portions of the study area. This spatial pattern was most apparent in Austin, TX, where there is a concentration of wealthy neighborhoods in the west. These are the neighborhoods with higher access to opportunity. However, most of the neighborhoods in east Austin show little access to child opportunities. In 2020, neighborhoods in East Austin included a larger percentage of people of color relative to the rest of the city, and some neighborhoods also had relatively large child populations. Similar racial/ethnic inequalities in the geographic distribution of child opportunity scores have been detected by other studies in other large metros across the United States (Acevedo-Garcia et a., 2020).

Concentrated disadvantage showed a similar pattern. While western neighborhoods, especially in Austin, show low sociodemographic disadvantage, the eastern neighborhoods seem to suffer more social, economic, and demographic disadvantages. The higher concentrated disadvantage has often been an indicator for lower collective efficacy and social cohesiveness (Sampson et al., 1999); thus, it was expected that these neighborhoods struggle with creating solid active support for children. The opportunity and concentrated disadvantage index showed a clear inequality between the west and east of the study area. Considering that some of the neighborhoods located on the eastern side include a very large child population, these aspects need more attention and extra effort from planners and city officials.

The analysis of parental perceptions led to a multi-dimensional discussion of

neighborhood walkability, opportunity, and collective efficacy. For parents, the discussion of neighborhood walkability goes beyond the mere existence of the adequate physical structure. While the latter is an important aspect, it is not enough for parents to let their children walk independently within their neighborhoods. Many parents are concerned about potential social and traffic hazards, thus prefer to accompany their children to school or any other place within the neighborhood environment. Some parents mentioned that they would like to give their children chances to walk alone or with friends independently, but they do not trust to do so despite living in walkable neighborhoods. High-speed streets, careless drivers, lack of traffic signs, criminals, and sex offenders were examples mentioned most by parents on the survey or during the interviews. This is in line with previous studies (Whitzman et al., 2010; Prezza et al., 2009; Carver, Temperio, and Crawford, 2008). On the same line, many parents would like to see more police patrols, traffic signs, and rules for speed reduction in their neighborhoods. Walkability was discussed from the cultural aspect during the interviews. Parents hesitate to let their children walk alone, fearing to be judged by neighbors as careless parenting. Socio-cultural factors influence independent child mobility at the individual and community levels by previous studies (Malone and Rudner, 2011).

Most parents showed to be satisfied regarding their neighborhood access to diverse opportunities. However, many believed that the amenities in their neighborhood parks need improvements. Many would like to see more parks and playgrounds in their vicinity with features for very young children and older children in elementary school. Like walkability, the concept of opportunity goes beyond the mere existence of opportunity. Despite the existence of diverse opportunities, some parents reported that

they cannot use them due to their neighborhood's walkability or social environment. For example, a park may be located within walking distance, but there are no sidewalks to get to it, or due to illegal activities, the environment of a park may not be safe. The three concepts of walkability, access to opportunity, and neighborhood's social environment are intertwined.

Parental perceptions of collective efficacy, or in other words, social cohesiveness and neighborhood stability, were generally positive based on the survey questions. However, a significant percentage of parents admitted that they do not trust their neighbors to keep an eye on their children. This problem was more discussed during the interviews. Most interviewees said they might trust very few neighbors who know each other for a long time, and they live next door. This could be an argument related to how neighborhoods are defined which could be discussed in a future study.

The spatial analysis of walkability, access to opportunity, and collective efficacy, did not show a specific geographic pattern in the data. Only a cluster of positive opinions regarding walkability showed in far northwest Austin, Texas. In the case of opportunity same spatial pattern showed up, but it was less significant. Collective efficacy showed a little cluster in a couple of West Austin neighborhoods. Overall, cluster analysis results cannot draw any conclusions because many surveys are needed for more accurate cluster analysis.

Analyzing the differences between parental perspective with expert indices confirmed that parents and experts look at the same aspects of the neighborhood very differently in some places. In general, downtown areas were identified as places where expert scores were higher than parents' scores. A few clusters detected the opposite in the

northwest and south Austin areas. Overall, the results show that expert indices do not always match residents' perceptions and needs. Expert indices examine a problem from a third-person perspective, which may lack the details that could only be obtained from the view of residents who firsthand experience a certain situation (Corburn, 2003). Citizen participation in the planning process is often a complicated, time-consuming, and expensive process (Rydin, 2007). Another important aspect of participatory planning is about how *participation* is defined and understood. Sometimes planning processes are participatory only to some extent. As discussed during one of the interviews, sometimes residents are self-motivated and try to participate in the planning processes to determine that their participation is nominal as experts already made the decisions. Defining participation has been one of the main dilemmas in urban planning history (Cornwall, 2008), but it is a key to remove the ambiguity on this concept and implement thorough participatory urban planning procedures.

8. LIMITATIONS OF PROPOSED STUDY

This study has some conceptual and methodological limitations. The concept of child-friendliness is discussed and examined from three aspects: walkability, opportunity, and collective efficacy. Although these aspects are known as the main pillars of neighborhood child-friendliness in the literature, they are not exhaustive. Child-friendliness is a more complex and multidimensional concept that needs to be examined from the individual and collective viewpoints at various geographical, social, and cultural levels.

Another limitation of this study regards the study area and data collection processes. After the pandemic, the data collection had to be conducted by Qualtrics data collection services leading to a change of the study area from Austin to Austin metro. This decision was made due to feasibility and financial considerations. Extending the study area to Austin metro increased the dispersity in survey collection, and therefore, several block groups had no survey data. Qualtrics did not gather survey respondents' contact information required to recruit participants for the follow-up interviews due to confidentiality. As a result, the interviewees were selected from the first batch of surveys collected before the pandemic. In Addition to fewer interviewees, this problem caused some discrepancies between data used for qualitative and quantitative analysis.

Ideally, from the methodological viewpoint, a greater number of surveys are needed to obtain more significant results and better understand parental experiences. Also, only if the number of the survey were significantly representative of each block group's population would it have been possible to generate a significant index based on local knowledge.

APPENDIX SECTION

Introduction

Thank you for your interest in this survey. This anonymous survey is designed by Shadi Maleki, a graduate student in the Department of Geography Texas State University, as part of her doctoral research and is being administered through Qualtrics XM Platform and professional data collection services. This survey is designed to learn about the parental perception of child-friendliness within selected school attendance zones within the City of Austin, Texas.

This survey is available in English and Spanish and will only take about 10 minutes to complete. If you would like to take the survey in any other language, we will try to accommodate you. Please contact: Shadi Maleki (shadimaleki@txstate.edu).

All answers are confidential, and participation is voluntary. Participants are free to stop participating at any time without negative consequences. Only participants who answer all questions in the survey will be compensated.

Risks

This survey does not represent any foreseeable risks to participants.

Benefits

This research benefits the local community by improving our understanding of the differences between expert and local knowledge in urban planning and informing parents and community decision-makers interested in improving Austin's neighborhoods.

Compensation

Participants will be compensated for the amount they agreed upon before they entered into the survey.

Confidentiality

The survey is anonymous. However, if any identifiable information obtained through open-ended questions, it will remain confidential and will be disclosed only with your

permission or as required by law. The members of the research team and the Texas State University Office of Research Compliance (ORC) may access the data. The ORC monitors research studies to protect the rights and welfare of research participants. All data will be kept for three years (per federal regulations) after the study is completed and destroyed.

Please answer these questions to the best of your ability. If you have any questions or concerns about this research, please contact (Shadi Maleki at (shadimaleki@txstate.edu) or her faculty advisor, Dr. Ronald Hagelman III at (rhagelman@txstate.edu).

This project [IRB# 6726] was approved by the Texas State IRB on [09/17/2019]. Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Denise Gobert 512-245-8351 – (dgobert@txstate.edu) or to Monica Gonzales, IRB Regulatory Manager 512-245-2334 -
(meg201@txstate.edu)

Screeners

S1. What is your zip code?

S2. Please indicate the age of your children:

No Children	9
0	10
1	11
2	12
3	13
4	14
5	15

6	16
7	17
8	18+

S3. How many children do you have in elementary school?

Default Question Block

Q1. Which elementary school does/do your child/children attend? (Please answer this question as it is necessary for the geographical analysis).

	School	Grade	Age
Child 1			
Child 2			
Child 3			
Child 4			
Child 5			
Child6			

Q2. Estimate the distance (in miles) from your residence to your child's/children's school:

- Less than 1 mile
- 1-5 miles
- 5-10 miles
- 10-15 miles
- 15+ miles

Q3. Please provide a street intersection near your residence (for example: intersection of street A and street B).

Street A ----------
Street B ----------

Q4. Estimate the distance (in minutes) from your residence that your child/children is/are allowed to travel on their own:

- 1-15 minutes
- 15-30 minutes
- 30-60 minutes

- 60+ minutes
- I do not allow my child/children to travel on their own.

Q5. Estimate the distance (in minutes) from your residence that your child/children is/are allowed to travel with friends:

- 1-15 minutes
- 15-30 minutes
- 30-60 minutes
- 60+ minutes
- My child/children are not allowed to travel with friends.

Q6. On an average school day, how does/do your child/children travel to school? (You can choose multiple options)

	Alone	with Friends	with Parents/Guardians
Car	☐	☐	☐
Bicycle	☐	☐	☐
Walk	☐	☐	☐
School bus	☐	☐	☐
City bus	☐	☐	☐
Other	☐	☐	☐

Q7. On a weekly basis, approximately how many times does/do your child/children play on your street?

- Daily
- Once a week
- A few times a week (2-4 times)
- Several times a week (4-6 times)
- My child/children do not play on my street.

Q8. On a weekly basis, approximately how many people do you interact with in your neighborhood?

- 1-5
- 6-10

- 11-15
- 15+
- I do not interact with people in my neighborhood

Q9. I am in contact with neighbors whose children go to the same school as my child/children.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Q10. I trust my neighbors to look after my child/children when I am not available.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Q11. Most of my neighbors have lived in our neighborhood for at least 5 years.
Strongly agree

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree
- Not sure

Q12. There are adults in my neighborhood that my child/children can look up to.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree
- Not sure

Q13. I can count on my neighbors to intervene if children are involved in an illegal or destructive behavior in my neighborhood.

- Strongly agree

- Agree
- Neutral
- Disagree
- Strongly disagree
- Not sure

Q14. Does your neighborhood have sidewalks?

- Yes
- No

Q15. The sidewalks in our neighborhood are well-maintained.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree
- My neighborhood does not have sidewalks

Q16. My child/children use the sidewalks in our neighborhood often.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree
- My neighborhood does not have sidewalks

Q17. Our neighborhood is safe for my child/children to walk or play alone.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Q18. Our neighborhood is safe for my child/children to walk or play with friends.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Q19. The trees in my neighborhood provide shade for pedestrians.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Q20. How far do you travel to do most of your food shopping?

- Less than a mile
- 1-5 miles
- 6-10 miles
- 11- 15 miles
- 15+ miles

Q21.Please provide the name/s and location/s of where you do most of your food shopping (for example: HEB in the intersection of A and B).

Q22. My family has convenient access to schools.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Q23. My family has convenient access to health care.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Q24. There are parks and playgrounds in our neighborhood.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree
- Not sure

Q25. The parks and playgrounds in our neighborhood are well designed.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree
- No parks

Q26. How often does/do your child/children visit a park or playground in your neighborhood?

- Daily
- Once or more times a week
- 1 to 3 times a month
- Several times a year (5-11 times a year)
- A few times a year (2-4 times a year)
- Once a year or less
- My neighborhood does not have parks or playgrounds.

Q27. Our neighborhood has spaces that my child uses to socialize with friends.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree
- Not sure

Q28. What feature/s do you wish to see added to your neighborhood to make it more child friendly? _____

Q29. What feature/s do you wish to see removed from your neighborhood to make it more child friendly? _____

Q30. Do you have any other concerns or recommendations regarding how to make your neighborhood more child friendly? _____

Q31. What is your age range?

- 18-25
- 25-35
- 35-45
- 45-55
- 55+

Q32. What is your gender?

- Male
- Female
- Other
- Decline to answer

Q33. What is your household size? (dropdown options)

Q34. How many adults live in your household? (dropdown options)

Q35. How many other family members live in your household? (dropdown options)

Q36. How long have you lived in Austin, Texas?

- Less than a year
- 1-2 years
- 2-3 years
- 3-5 years
- 5-10 years
- 10+ years

Q37. How long have you lived in your current neighborhood?

- Less than a year
- 1-2 years
- 2-3 years
- 3-5 years
- 5-10 years
- 10+ years

Q38. What is the highest level of education you have completed?

- Some secondary or high school
- High school graduate
- Some college, but no degree
- Associate or technical degree
- Bachelor's degree
- Post-graduate masters or professional degree
- PhD, law, or medical degree

Q39. Do you identify as: (you may select more than one)

- White
- Hispanic
- Black or African American

- American Indian or Alaska Native
- Asian
- Native Hawaiian or

  Pacific Islander

  Other

- Prefer not to say

Q40. Estimated annual household income

- Less than $10,000
- $10,000-$29,000
- $30,000 - $49,999
- $50,000 - $79,999
- $80,000 +
- Prefer not to say

Q41. What is your marital status?

- Single
- Married
- Domestic Partners
- Prefer not to say
- Other:_____

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