NEIGHBORHOOD WALKABILITY AND SAFETY CONSIDERATIONS IN NEIGHBORHOOD CHOICES

A Dissertation

by

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ABSTRACT

There are few studies examining the interrelationships between objectively evaluated neighborhood quality and preferences for walkable neighborhoods, which are considered in actual residential location choices. Furthermore, little is known about how concordance and discordance between neighborhood quality and considerations affect walking behaviors and the satisfaction of residents.

Using survey and objectively measured datasets from two recently completed research projects which were carried out in non-metropolitan communities (four urban and three rural towns) in Texas, Study 1 identified who considered walkability and safety when selecting a residence, and their environmental variations related to walkability and safety considerations by age groups and community settings. Results from binomial logistic regression models showed that non-White, pro-safety, utilitarian walkers, non-obesity, less education, long residential length, and a home near CBDs were personal predictors of the odds of walkability considerations, while non-Hispanic, pro-attractiveness, utilitarian walkers, short length of residence, and rural living were predictors of the odds of safety considerations. High perceived safety from traffic but low safety for walking were related to both neighborhood considerations. Walkability consideration resulted in choices of more neighborhood destinations, fewer single family residences, and industrial land uses. Safety consideration brought about selections of more multifamily residences and service destinations, and fewer recreational lands and food destinations.

Study 2 examined walking behaviors and perceived neighborhood livability of those who lived in a condition called “neighborhood discordance”, the mismatch between the preferred versus actual neighborhood environments, and the interrelated links among neighborhood considerations, discordances, and neighborhood-level walkability and safety indices conceptualized and developed from the existing literature. Generalized structural equation models (GSEMs) with multilevel modeling approaches found that traffic and walking related perceived safety, objectively measured pedestrian infrastructures, street connectivity, and violent crimes were common environmental correlates of discordances. Both preference discordance and walkability discordance were associated with a limited level of walking for transportation. For safety, safety discordance was linked to a restricted level of perceived safety, but preference discordance was related to higher safety perceptions. A livability perception was a function of SES, preferences for walkability and safety, walkable neighborhood environments, walking for any purpose, and safety perception.

This dissertation research presents significant contributions in understanding various housing demands for active lifestyles and the life satisfaction of different resident groups. A comprehensive examination of interrelationships among neighborhood choices and preferences, perceptions of neighborhood environments, and walking behaviors highlights the importance of positive attitudes and an adequate supply of walkable and safe neighborhoods.

DEDICATION

To my parents and my brother

for their patience and support

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All work for this dissertation was completed independently by the student.

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NOMENCLATURE

GSEM	Generalized Structural Equation Modeling (Model)
NDVI	Normalized Difference Vegetation Index
NPQ	Neighborhood Environment, Physical Activity, and Quality of Life Survey
NSI	Neighborhood Safety Index
STW	Small Town Walkability Survey
UWI	Utilitarian Walkability Index

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CHAPTER I

INTRODUCTION

1.1 BACKGROUND

New Urbanism proponents and planners have criticized urban sprawl and suburb-type developments that have contributed to auto-dependency which have caused excessive use of energy, land, and water resources creating social and economic problems (Burchell et al., 2002; Calthorpe, 1993). These proponents have promoted "traditional" types of neighborhoods with high density, street connectivity, mixed land uses, and walking- and transit-orientation, as healthier and more sustainable alternatives to the suburb-type developments (Boarnet & Crane, 2001; Crane, 2000). Influenced by the New Urbanism movements, a new wave of studies have focused on the attributes of the built environment in terms of restraining automobile travel (Cervero & Kockelman, 1997; Handy, 1996; Kitamura, Mokhtarian, & Laidet, 1997) and encouraging non-motorized travel (Greenwald & Boarnet, 2001; Rodríguez & Joo, 2004). These studies have identified the attributes of built environments related to travel behaviors with respect to land uses, transportation systems, and urban design features (Saelens & Handy, 2008). A large number of empirical studies and comprehensive reviews have confirmed that the traditional residential or commercial settings are more conducive to non-motorized/active travel such as walking and are less dependent on automobile travel than are contemporary settings (Frank, Schmid, Sallis, Chapman, & Saelens, 2005; Saelens, Sallis, & Frank, 2003). To encourage the development of walkable communities, it is important to identify whether the general public is actually willing to live in and is likely to be satisfied with life in such communities. Even though some studies have attempted to show evidence that the benefits from this type of development are supported to some extent by the general public (Handy, Sallis, Weber, Maibach, & Hollander, 2008; Myers & Gearin, 2001), the nature of support may merely reflect the collective public attitude. It is not guaranteed that these attitudinal factors are actually translated into residential location choices (neighborhood choices) made by individuals (Handy et al., 2008; Myers & Gearin, 2001).

1.2 RESEARCH OBJECTIVES AND SIGNIFICANCES

To understand the nature and extent of demand for walkable neighborhoods, exploring the specific factors (personal and environmental) associated with neighborhood preference, as a key factor leading to neighborhood choice, is a prerequisite. Understanding how certain preferred environmental attributes differ by personal or household traits can also be valuable in proposing specific development patterns to effectively support the preferences of different resident groups. Furthermore, it is still questionable whether the "neighborhood discordance", between the expected and the actual neighborhood environments, operates as a loss of expected utility constraining the desired level of active (walking-oriented) lifestyles and livability (as a good place to live or raise children), or merely as socio-demographical or geographical variations in neighborhood choices meeting the demands.

Objective 1. To identify residential demands for neighborhood walkability and safety, and their variations by personal or household traits and community settings.

Specific objectives of this study are to identify *who* choose their residential locations because of their preferences for neighborhood walkability or safety; and *what* environmental features are preferred by specific subgroups of residents who consider neighborhood walkability or safety for residential choices, controlling for other significant confounding factors (e.g. race/ethnicity, educational attainment, the length of residence).

Objective 2. To examine the daily behaviors, neighborhood satisfactions, and environmental needs of those who live with "*neighborhood discordance*", defined as the mismatch between neighborhood preferences and neighborhood environments, to understand the differences between expectations and reality in neighborhood choices.

Specific objectives of this study are to examine the relationships between neighborhood quality considerations and objectively measured neighborhood environments; if neighborhood discordance is associated with specific personal and/or environmental factors; and if the neighborhood discordance has an independent influence on walking behaviors after controlling for the key confounding variables.

This dissertation research provides several contributions to the existing literature and fields of housing markets, community development, urban planning, and public health. First, this study aims to discover the direct relationships between the objective measures of current neighborhood environments and residential preferences for neighborhood walkability and safety, which have been insufficiently examined. Second, the current study explores the nature of understudied population groups such as older-adults and residents of rural small communities, and their personal/household and environmental distinctions in considering neighborhood walkability and safety, in order to understand the varying housing demands by different populations and present beneficial information. Third, the present study attempts to develop a systematic measurement framework to objectively evaluate neighborhood level walkability and safety using GIS techniques, and identify the concordances and discordances between neighborhood considerations and objectively evaluated environmental quality in neighborhoods. Fourth, it carries out a comprehensive examination of the intricate interrelationships among neighborhood discordances, neighborhood choices, neighborhood preferences, walking behaviors, perceived safety, and livability using a structural equation modeling approach.

1.3 CONCEPTUAL FRAMEWORK OF DISSERTATION STUDY

The conceptual framework of this study depicts the relationships among personal- and household-level characteristics, objective and perceived measures of physical and social environments, neighborhood considerations and neighborhood choices related to neighborhood walkability and safety, concordance and discordance between neighborhood considerations and neighborhood choices, walking behaviors and perceived neighborhood safety, and neighborhood livability (Figure 1). The basis of the conceptual framework is derived from the social ecological theory (McLeroy, Bibeau, Steckler, & Glanz, 1988), which is useful for conceptualizing and testing multilevel influences on individual behaviors across built and socioeconomic environments as well as intrapersonal factors such as neighborhood considerations (Boone-Heinonen, Gordon-Larsen, Guilkey, Jacobs, & Popkin, 2011). In terms of multiple levels of influences, intrapersonal factors, interpersonal-level factors, and community-level factors influence neighborhood walking behaviors, perceived safety, and neighborhood satisfaction (Sallis et al., 2006; Sallis, Owen, & Fisher, 2008). These levels influence neighborhood walking behaviors, and the influences interact across intrapersonal factors (e.g. age) and community-level factors (e.g. neighborhood discordance). Influences of factors on walking behaviors at each level also vary according to purposes of walking such as recreational or utilitarian/transportation (Cao, Handy, & Mokhtarian, 2006; Lee & Moudon, 2006b). Furthermore, policy or environmental interventions to support walking-oriented lifestyles can influence factors at all levels.

Personal- and household-level characteristics such as age, gender, SES, lifestyle preference, regional locations of homes, and others interact with walking behaviors, and also alter the relationships among built environments, neighborhood considerations, and walking behaviors (Frank, Saelens, Powell, & Chapman, 2007; Handy, 2005; Saelens & Handy, 2008; Van Dyck, Cardon, Deforche, Owen, & De Bourdeaudhuij, 2011). SES factors are captured by measures for household income, educational attainment, and occupational status. The lifestyle factors affecting residential location choices include car ownership, household size, and living with children (Handy et al., 2008; Myers & Gearin, 2001; Schwanen & Mokhtarian, 2007). In terms of overall quality of neighborhoods, in the existing literature, environmental features of overall neighborhood walkability generally encompass residential density, access to non-residential land uses, street connectivity, pedestrian or bicycle facilities, aesthetics, safety from traffic, and safety from crime (Saelens, Sallis, & Frank, 2003). Overall neighborhood safety related to walking has three dimensions: safety from traffic, safety from crime, and pedestrian-related safety (e.g. street lighting, surveillance, dogs, the condition of pedestrian infrastructures, air quality) (Bracy et al., 2014; Foster & Giles-Corti, 2008). The conceptual models integrate the two processes of neighborhood choices and travel choices, conceptualizing the relationships between neighborhood considerations and residential environments, and between neighborhood environments and travel choices. Neighborhood considerations are associated with relevant personal- and household-level characteristics and environmental features (Handy et al., 2008; Lovejoy, Handy, & Mokhtarian, 2010). The neighborhood choices, neighborhood considerations, and the mismatch between the two are interrelated and have independent influences on walking behaviors. As distinct from the neighborhood choices captured by the objectively evaluated neighborhood quality, perceptions of neighborhood environments have independent and stronger influence on walking behaviors (Gebel, Bauman, & Owen, 2009; Gebel, Bauman, Sugiyama, & Owen, 2011). Walking behaviors also increase the chance of being exposed to unsafe environments (Jacobsen, 2003). The overall perceptions of neighborhood safety and other perspectives of environments (e.g. social aspects, the attractiveness of neighborhood) are generated by experiencing the actual environments (Arvidsson, Kawakami, Ohlsson, & Sundquist, 2012). If a preferred characteristic of a residential neighborhood is unmet, the neighborhood environments may act as a barrier to the desired behaviors such as walking (Schwanen & Mokhtarian, 2005b). Further, community and policy level interventions to encourage walking behaviors are effective in more residents being satisfied with life in the neighborhood (Lovejoy et al., 2010).

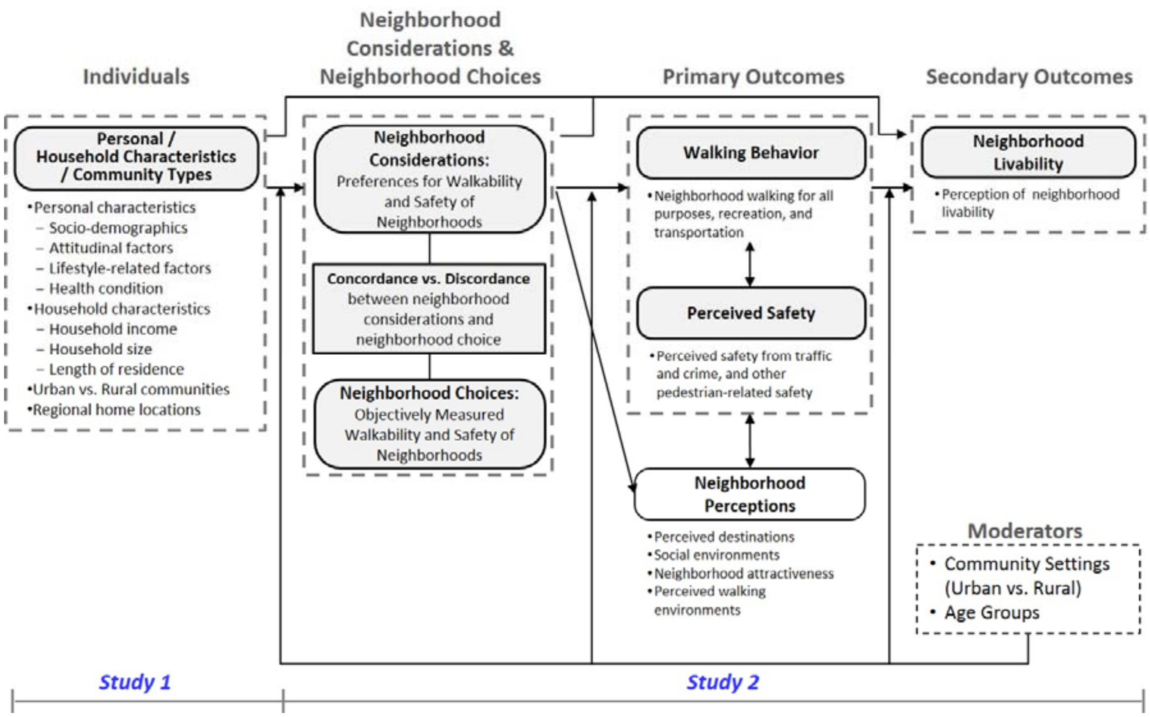

Figure 1 Conceptual Framework of Dissertation Study

1.4 STRUCTURE OF THE DISSERTATION

Chapter I of this dissertation includes the background, research objectives, significances, and an overall conceptual framework of the study.

Chapter II discusses the literature reviews regarding 1) residential preferences and choices relevant to neighborhood quality, 2) relationships between residential preferences, walking behaviors, and neighborhood livability, 3) subgroup variations in neighborhood preferences, choices, and walking, and 4) methodological issues such as measurements of composite walkability and safety and justifications of neighborhood discordance.

Chapter III describes study areas, data collection methods, and measures which are used to examine the relationships among neighborhood preferences, neighborhood choices, and behavioral and perceptional outcomes.

Chapter IV, "Study One: Residential Demands for Neighborhood Walkability and Safety across Community Settings and Age Groups", focuses on identifying 1) who consider walkability or safety when choosing their neighborhoods; 2) what objectively measured environmental features exist in the neighborhoods chosen by those who prefer walkability or safety for residential choices; and 3) how such features, chosen by those who consider walkability or safety, differ by specific subgroups of residents.

Chapter V, "Study Two: Walking, Neighborhood Safety, and Neighborhood Livability - The Role of Neighborhood Discordance", examines 1) the relationships between neighborhood considerations and objectively measured environmental features; 2) if neighborhood discordance is associated with specific personal and/or environmental factors; and 3) if the neighborhood discordance has an independent influence on walking behaviors, perceived safety, and perceived neighborhood livability.

Finally, I summarize the findings of two independent studies in Chapter VI. I also discuss implications and contributions to urban planning, housing policy, and public health.

CHAPTER II

LITERATURE REVIEW

2.1 RESIDENTIAL CHOICE AND PREFERENCE FOR NEIGHBORHOOD QUALITY

2.1.1 Residential Preference Research

Residential and neighborhood environments have been acknowledged as venues to support activities of economy, culture, society, and health, so that understanding the environments has attracted growing attention from community design, urban planning, and other disciplines (Diez Roux & Mair, 2010). Examining diversified residential preferences, residential demands, and perceptions of residential environments may be a prerequisite to providing supportive neighborhood environments for the activities at community levels (Boone-Heinonen et al., 2011). Residential preferences have been captured using the traditional housing demand research method by simply asking about the willingness-to-move, residential preferences, and the immediate financing reasons or demands for expanding dwellings (Boumeester, 2011). In addition, demographic and SES characteristics such as the type of household and income were also surveyed to be used for background information related to residential preferences. Residential preferences were generally captured with revealed and stated preferences. Revealed preferences are inherent preferences derived from residential choices which jointly resulted from personal preferences, market situations, policies, and other all other internal and external factors (Jansen, 2014). Stated preferences stood for responses to questions about desired residences. Thus, the stated preferences were less realistic than the revealed preferences in general, and those two preferences were not strongly associated with each other (Aero, 2006). From a body of residential preference literature, dwelling features included the dwelling types, the number of rooms, the presence and size of backyards, the presence and size of balconies, ownership, housing price, year built, and parking spaces. Environmental features were the type of neighborhood, amenities in the neighborhood, public transits, green or water spaces, parking places, safety from traffic, and density. Personal and household socio-demographics included the type of household (e.g. single, family, single-parent family), the number of family members, ages of members, employment status, working hours, household income level, and educational level (Boumeester, 2011).

2.1.2 Residential Preferences for Neighborhood Walkability

While the residential preferences for neighborhood environments have been understood as related to personal/household characteristics, lifestyle preference, and accessibility to jobs or services, less examined are the impacts of predispositions toward walking behaviors or walkable environments on residential choices or on residential satisfactions (Boumeester, 2011; Lund, 2006; Schwanen & Mokhtarian, 2007). A few studies have surveyed public support or opinions for the walking-oriented neighborhood designs characterized as higher-density, mixed-use community structures (Handy et al., 2008; Morrow-Jones, Irwin, & Roe, 2004; Myers & Gearin, 2001; Talen, 2001). The findings showed that the walking-oriented designs of communities were preferred by educated residents (Morrow-Jones et al., 2004), residents without children (Talen, 2001), and residents with children and older adults (Myers & Gearin, 2001). According to Handy et al. (2008), residents who were highly-educated, not married, non-White, with children, in a non-rural area were more likely to support the idea of a traditional type of community development. A recent study investigated the public desire for compact development toward housing and neighborhood characteristics and walking levels using a stated-preference survey including 16 attitudinal items (Liao, Farber, & Ewing, 2015). The data collections were achieved through a part of the Utah Household Travel Survey conducted in Salt Lake, Utah, Davis, and Weber Counties, Utah, in 2012. The discrete choice models with a set of latent discrete preference variables were estimated. Both binomial logistic regression models and latent class (latent discrete) models were estimated to identify determinants of preferences for compact development. They found that preferences for compact development were more likely to be reported among residents with fewer children, low income and housing renters, and those who preferred social heterogeneity and had less desire for privacy. The study explored socio-demographical factors and other attitudinal factors toward housing and neighborhood characteristics underlying preferences for compact development. However, those studies were limited in understanding collective public attitudes or stated preferences (Jansen, 2014).

2.1.3 Walkability Preferences and Neighborhood Choices

While several studies investigated disagreements of stated preferences with current neighborhood types in examining effects of disagreements on travel behaviors (Schwanen & Mokhtarian, 2003, 2005b), a few studies attempted to compare residential self-selection considerations (neighborhood considerations) and current neighborhood environments. The studies reported an inconsistency between objective and perceived measures in matching with a neighborhood walkability consideration. Neighborhood walkability consideration was positively associated with perceived neighborhood walkability, while not significantly with objective walkability (Van Dyck, Cardon, Deforche, Owen, et al., 2011; Yu & Zhu, 2015). The finding implies distinctions between stated-preferences for residence and neighborhood considerations, regarding neighborhood choices. Yu and Zhu (2015) mainly examined the influences of perceived environments, personal factors, and neighborhood consideration for proximity to schools and a walkable neighborhood on commuting behaviors of children. Parental survey data, collected from 20 elementary schools in Austin, Texas, were used to build structural equation models. The results identified significant personal or household factors and perceived environmental measures as well as neighborhood considerations of school proximity and neighborhood walkability. This showed both neighborhood considerations were significant determinants in choosing commuting modes for elementary-aged children. Using binary logistic regression models, they also attempted to identify personal determinants of neighborhood consideration for school proximity and neighborhood walkability. The results showed that Hispanic and less-educated parents were more likely to consider the proximity to school when choosing home locations. However, they were unable to identify any significant personal determinants of neighborhood walkability consideration. Furthermore, the study compared perceived environments and neighborhood considerations, using logistic regression analyses. As a result, parents with a neighborhood consideration were more likely to perceive their residences as close enough to school (61.7%) or walkable (74.0%).

Van Dyck, Cardon, Deforche, Owen, et al. (2011) attempted to observe neighborhood considerations differing by socio-demographic traits and the levels of neighborhood walkability objectively evaluated, recruiting 412 adult residents aged 20-65 years from 24 neighborhoods stratified based on objective walkability assessments in Ghent, Belgium. They collected socio-demographics, and self-reported and objectively measured physical activities, using the International Physical Activity Questionnaire (IPAQ) and accelerometers. Neighborhood selection scores including walkability consideration measured with a five-point Likert scale from 'not important at all' to 'very important' were compared between groups based on gender, age, and education using t-tests. Multilevel analyses taking clustering effects at the neighborhood level were used to investigate the effects of objective walkability on physical activities of all the participants and only participants with neighborhood walkability preferences. To assess objective neighborhood walkability, a neighborhood-level walkability index, mentioned in the methodology section of this study, was employed. Their findings demonstrated that neighborhood walkability was more likely to be considered by women, older adults, and less-educated residents than their counterparts. Notably, no significant difference was found between high and low walkable neighborhoods in the walkability selection scores (Van Dyck, Cardon, Deforche, Owen, et al., 2011).

These studies contained limitations in explaining how the neighborhood environments were chosen because of or regardless of predispositions that influence behaviors and quality of life among residents, and what specific environmental features are involved in neighborhood choices based on walkability preferences. A few studies addressed personal determinants of walkability considerations and the discordances between current attitude and community-type, but there is still a research gap in identifying whether environmental differences between expectations and reality in neighborhood choices operate as a loss of expected utility constraining the desired levels of behaviors and neighborhood satisfactions, or merely as socio-demographical or geographical variations in neighborhood choices meeting the demands. Therefore, it is necessary to investigate more diverse resident groups and neighborhood settings and identify properly supportive environments to promote active behaviors and improve the satisfaction of residents.

2.2 RESIDENTIAL PREFERENCE, WALKING, AND LIVABILITY

2.2.1 Residential Self-Selection and Walking

As planning and transportation policies share objectives to reduce dependence on the automobile, encourage alternative travel modes such as walking, bicycling, and transit, and shorten distances between locations (Cervero & Kockelman, 1997), a body of literature has grown to address the relationships between the built environment and travel behavior (Handy, 2005). Through numerous empirical studies and comprehensive reviews, there is a consensus about some of the features of the built environment associated with particular travel behaviors. That is, walking-oriented community settings, depicted with high densities in development, mixed land uses, and gridded street patterns, are more conducive to active travel or neighborhood walking, and are less dependent on automobile travel than are the contemporary settings (Frank et al., 2005; Saelens, Sallis, & Frank, 2003). More recently, growing attention has been paid to attitudinal factors toward travel mode choice, residential location selection, and social environmental factors such as crime and safety issues in the travel behavior research field. These factors are very important in predicting individuals' walking or active behaviors, which are yet less certain in relevant importance and relationships with built environmental factors (Cao, Mokhtarian, & Handy, 2009). "Residential self-selection" is related to attitudinal factors, which are predispositions of individuals preferring a residential location conducive to a particular travel behavior (Litman, 2005). Some residents select residential locations based on their preferred travel modes and land uses. Thus, if the variations of environments in travel behaviors are explained solely by the attitudinal factors, the built environment-travel relationship is just spurious and individuals use their favorite travel mode because they selected the location on that basis (Handy, Cao, & Mokhtarian, 2005, 2006). The central questions have been how much residential self-selection alters the environment-travel relationship and if the built environment has an independent influence on travel behavior (Cao, Mokhtarian, & Handy, 2008; Cao et al., 2009). Even though the general findings from the literature indicate both residential self-selection and built environment separately account for travel mode choices (Cao et al., 2009), little is addressed about how the two constructs – the built environments (neighborhood choices) and residential self-selections (neighborhood consideration) – are related to each other (Cao et al., 2008).

2.2.2 Neighborhood Discordance and Walking

Another group of studies compared types of current communities and the residents' attitudes, and examined to what extent the discordance influences travel behaviors by modes (Frank et al., 2007; Schwanen & Mokhtarian, 2005b). The studies attempted to identify the relative importance of attitudinal and built-environmental factors by comparing concordance and discordance groups, according to matching desired and current neighborhood types of residents living in metropolitan areas (e.g. the San Francisco Bay area in California, Atlanta in Georgia). The neighborhood types were categorized based on their structures and layouts (i.e. urban town with high-density, suburban town with moderate or low density) (Schwanen & Mokhtarian, 2005a, 2005b) or objectively assessed walkability (Frank et al., 2007). Personal information, neighborhood preferences, and travel behaviors were captured by surveys, while built environments were measured through objective data. The neighborhood preferences were measured with tradeoff questions, asking respondents to choose their desired neighborhood types representing pedestrian-oriented versus auto-oriented neighborhoods. The neighborhood dissonance group was compared twice with the concordance group within the same desired neighborhood type and within the same actual neighborhood type, to identify the relative importance of influences of attitudes and built environments. The findings of the studies imply that both attitudinal and environmental factors have independent impacts, and a cognitive dissonance between desire and reality constrains the desired behaviors (Frank et al., 2007; Schwanen &

Mokhtarian, 2005a, 2005b). The matching rates ranged from about 70% to 80% between preferred and current types of residences (Schwanen & Mokhtarian, 2005b).

According to a multi-state study carried out in Twin Cities, Minnesota and Montgomery County, Maryland, urban residents preferring an urban environment were more likely to walk for the utilitarian purpose than suburban residents preferring a suburban environment (Cho & Rodríguez, 2014). However, significant differences were not found related to neighborhood locations or preferences for neighborhood environment for recreation walking. A Canadian study found that an unmet demand for neighborhood walkability was more likely to be found among residents living in low walkable suburban areas in the Greater Toronto Area and Metro Vancouver, Canada (Frank, Kershaw, Chapman, Campbell, & Swinkels, 2014). Exploring associations between built environment, travel behavior, and health status, studies found that higher preference for walkable neighborhoods is associated with 1) more walking for utilitarian purposes, 2) more frequent transit use and 3) driving fewer kilometers. Another recent study attempted to focus on individuals' behavioral responses to built environmental interventions, examining concordance/discordance between current neighborhood types and personal attitudes toward travel modes using their interaction terms on commuting mode choice, although it addressed travel preferences for driving automobiles vs. light rail transit (LRT) (Cao, 2015). Using the 2011 data from the Minneapolis–St. Paul metropolitan area, two separate ordered logit models were estimated with neighborhood types, attitudes toward travel modes, their interactions, and demographics, to compare urban vs. suburban neighborhoods and suburban vs. LRT neighborhoods. However, the interactions between neighborhood types and travel attitudes had no significant impact on driving commuting frequency, while the effects of neighborhood type on the transit commuting frequency differed by transit preference. Specifically, urban consonances (pro-transit, pro-bike, and pro-walking attitude in urban areas) have the highest frequency of transit commuting, followed by suburban dissonances, urban dissonances, and suburban consonances.

Even though the studies addressed the interrelationships between desirable and current neighborhood types, the measurements of stated preferences for neighborhood types were to capture attitudes which respondents currently possess. The attitudes toward behaviors and land use were able to be restructured by community attachment or a “cognitive dissonance reduction”, which contributes to adapting to current environments over time and reducing stress from the mismatch (Schwanen & Mokhtarian, 2007; Talen, 2001). Therefore, it might be misleading to conclude that the current preferences of residents are related to neighborhood choices. Furthermore, the studies were designed mainly to focus on comparing urban- and suburban-type neighborhoods in metropolitan areas.

2.2.3 Neighborhood Preference and Neighborhood Satisfaction

The neighborhood environments and predispositions toward neighborhood environments imply neighborhood choices and neighborhood preferences (Schwanen & Mokhtarian, 2007). Residential choices result from optimizing a variety of demands and preferences of individuals among possible alternatives (Ge & Hokao, 2006). The housing demand literature has demonstrated that residential choice is achieved through tradeoffs among preferences for the features of a dwelling and residential environments (Boumeester, 2011; Ge & Hokao, 2006; Schwanen & Mokhtarian, 2007). Among the residential preferences for dwelling and environmental features, the considered characteristics in residential choices depend on life cycle stage, household or socio-demographic characteristics, lifestyles, and other background characteristics (e.g. length of residence, residential experience) (Schwanen & Mokhtarian, 2003; Talen, 2001). Residential environments chosen based on preferred attributes of residences and socio-demographic traits of individuals are closely related to residential satisfaction, which is about the extent to which residents' desires are met (Campbell, Converse, & Rodgers, 1976; Garling & Friman, 2002).

Handal, Morrissy, and Barling (1981) investigated a cognitive discordance between perceived and preferred characteristics of current residences causing residential dissatisfaction. Using surveys, they assessed neighborhood satisfaction, and the perceived and ideal characteristics related to social and physical aspects of a residential neighborhood. The 120 participants were recruited from a community with townhouses, middle-class residents, and a racial balance in St. Louis, Missouri. Both perceived and preferred characteristics and the differences between scores measuring the characteristics were assessed to identify contributions to neighborhood satisfaction. The discordances between the characteristics were shown as negatively associated with neighborhood satisfaction in their multiple regression analyses (Handal et al., 1981). As an aspect of neighborhood satisfaction, the residential neighborhood environments are important as venues for preferred behaviors or lifestyles (Garling & Friman, 2002). However, the evidence is less clear on how neighborhood satisfaction is accomplished through achievements of desired daily behaviors and supportive neighborhood environments (Lund, 2006).

2.2.4 Neighborhood Walkability, Safety, and Neighborhood Satisfaction

Prior studies have identified environmental determinants of the neighborhood satisfaction of residents from the aspects of built, social, and economic environments (Lovejoy et al., 2010; Sallis et al., 2009; Van Dyck, Cardon, Deforche, & De Bourdeaudhuij, 2011). Among the environmental determinants, overall neighborhood walkability presented mixed findings in that objectively measured walkability was positively associated with neighborhood satisfaction among high-income residents (Sallis et al., 2009), while the perceived walkability of a neighborhood was shown to have a negative association with neighborhood satisfaction (Lovejoy et al., 2010; Van Dyck, Cardon, Deforche, & De Bourdeaudhuij, 2011). Previous research has found that neighborhood satisfaction was negatively related to residential density (Adams, 1992; Van Dyck, Cardon, Deforche, & De Bourdeaudhuij, 2011), and positively associated with the proximity to utilitarian destinations (e.g. retails, services) and workplaces (Cook, 1988; Hur & Morrow-Jones, 2008). The associations with street connectivity and mixed land uses were not yet evident (Adams, 1992; Van Dyck, Cardon, Deforche, & De Bourdeaudhuij, 2011).

Captured by safety for walking, safety from crime and traffic, the presence of places for activities, and the quietness of neighborhoods, perceived neighborhood safety was also a determinant of neighborhood satisfaction and was consistently found in the previous investigations (Hur & Morrow-Jones, 2008; Lovejoy et al., 2010; Mohan & Twigg, 2007). While the intensity level of physical activity was found to have an association with higher scores for health-related quality of life (HRQL) (Brown et al., 2003; Vuillemin et al., 2005; Wendel-Vos, Schuit, Tijhuis, & Kromhout, 2004), little research has been done on a direct relationship between walking behaviors and life or neighborhood satisfaction (Fisher & Li, 2004). Furthermore, a plausible influence of neighborhood walkability or walking on perceived safety of residents is still less understood from existing literature (Foster & Giles-Corti, 2008).

2.3 SUB-GROUP VARIATIONS: URBAN VS. RURAL AND OLDER VS. MIDDLE-AGED ADULTS

2.3.1 Subgroup Variations in Relationships among Neighborhood Preferences, Neighborhood Choices, and Walking

Several studies partially examined subgroup variations such as ethnicity, gender, and geographic variations in environment-walking or neighborhood preference-choice relationships. It is important to understand the subgroup variations in relationships among all constructs, to provide appropriate environmental interventions for encouraging daily walking behaviors and to foster walkable environments meeting the various needs of neighborhood environments according to targeted populations (Swenson, Marshall, Mikulich-Gilbertson, Baxter, & Morgenstern, 2005). Some studies found socio-demographical traits moderating the relationships between environmental factors and walking behaviors. For example, Plaut (2005) reported that home-renters in central cities of metropolitan areas were more likely to walk to work than home-renters in other locations or home-owners. Shigematsu et al. (2009) found that all characteristics (e.g. residential density, mixed land uses, street connectivity) regarding traditionally designed communities were associated with transportation walking among younger adults (20-39 years), unlike all other age groups influenced by a few characteristics. Suminski, Poston, Petosa, Stevens, and Katzenmoyer (2005) reported that neighborhood safety and access to destinations are correlates of walking among women, while the condition of sidewalks and streets and aesthetics are associated with walking among men.

When it comes to neighborhood consideration, younger adults (≤ 45 years) were more likely to consider walkable residential environments than older adults (> 45 years) (Van Dyck, Cardon, Deforche, Owen, et al., 2011). A recent study examined the associations between the built environment and walking in a large metropolitan area and rural small towns (Stewart et al., 2016). The urban Seattle area was selected as the metropolitan area, while nine small towns were recruited in Washington, Texas, and the Northeast. From samples of the general population (18 years or older and no mobility problems), walking minutes measured using an accelerometer and travel diary survey were estimated with objective and surveyed measures of the built environment utilizing negative binomial regression models for three samples: (a) the Seattle sample, (b) the small town sample, and (c) the total sample. The number of neighborhood restaurants was a positive correlate of utilitarian walking in metropolitan cities, while the association was negative in small towns. Perception of slow traffic on adjacent streets was a positive correlate of recreational walking, but insignificant in Seattle. Looking at neighborhood considerations, walkability importance was considered by more residents from metropolitan areas, while safety importance was considered by more residents from small towns when choosing a neighborhood. As a companion study, a study examined environmental correlates of walking in the nine rural small towns (Doescher et al., 2014). Using telephone survey data collected from a larger sample, the odds of utilitarian walking and the high level of walking (≥150 minutes per week) were estimated with objective and surveyed measures of the built environment through mixed-effects logistic regression models. Higher odds of utilitarian walking were associated with the perceived presence of crosswalks, pedestrian signals, and park/recreational land uses, and also objectively measured industrial land uses.

Specifically, older adult and rural resident populations have attracted growing attention as disadvantaged groups who do not participate in recommended levels of physical activity for health benefits, and are at high risk for chronic diseases, associated functional disability, and declining overall health (Centers for Disease Control and Prevention, 2008; Martin et al., 2005). The health disparity of the population groups is also attributed to inaccessibility to medical care and other public services in rural neighborhoods (Bushy, 1997; Haynes, Bentham, Lovett, & Gale, 1999), and inadequate provisions for health or social services and infrastructures for older adults (Schieman & Pearlin, 2006). Further, provisions of neighborhood environments supportive of alleviating health disparities and meeting residents' needs will influence neighborhood satisfaction and health-related quality of life for those vulnerable population groups.

However, there is little peer-reviewed research that examines age and geographical variations in walking behaviors about neighborhood preferences/considerations and choices.

2.4 METHODOLOGICAL ISSUES

2.4.1 Composite Measures of Walkability and Safety

The Physical Activity Environments (PAE) Measure (objective composite measure) is a comprehensive measure that includes the Utilitarian Walkability Index and the Playability Index (Frank et al., 2012; Saelens et al., 2012). This walkability index encompassed two main categories of walkability measures using a utilitarian walkability index and playability index. High physical activity environments were assumed to have a higher than median summed z-score on residential density, retail floor area ratio, land-use mix, and street connectivity, and at least one high-quality park evaluated by an audit tool, the Environmental Assessment of Public Recreation Spaces tool (Frank et al., 2012; Saelens et al., 2012). In the utilitarian walkability index, the net residential density was measured with the ratio of residential unit numbers to the land areas involved in residential use per half-mile buffer from home. The retail floor area ratio was the ratio of building floor area to the land floor area of retails to capture parking services. Street network connectivity was captured by the ratio of the number of intersections to the area of the block group. Land use mix was a measure based on entropy capturing five land uses including residential, retail, entertainment, office, and civic land uses. The z-scores were computed across the different metropolitan regions separately to standardize the distributions of block groups in each region (Frank et al., 2010). They developed a playability index based on public park proximity and availability, and quality of features. Park accessibility was measured by enumerating parks within unit areas. Park-quality measures were captured by in-field park audits for trails or paths, water features, playground equipment, and so on.

However, the walkability index was designed to focus on evaluating metropolitan cities with high-density (Frank, Andresen, & Schmid, 2004; Frank et al., 2005). Thus, to apply it to areas with low-to-medium density, it was necessary to develop a new method by adopting the ideas of the Walk Score measuring accessibility to destinations and adding evaluations of walking-friendly infrastructure (Carr, Dunsiger, & Marcus, 2010a, 2010b). From previous studies, safety-related correlates of walking are categorized into three dimensions: safety from traffic, safety from crime, and pedestrian-related safety, which includes risks related to street lighting, surveillance, dogs, the condition of pedestrian infrastructures, and air quality (Bracy et al., 2014; Foster & Giles-Corti, 2008). Composite measures for neighborhood safety were rarely addressed and were limited to audit data and survey data (Alfonzo, Boarnet, Day, Mcmillan, & Anderson, 2008; Suminski et al., 2005).

2.4.2 Discordance between Perceived and Observed Measures of Neighborhood Environments

Most studies have found that one-third of residents live in neighborhoods where objective and perceived environments disagree with respect to neighborhood walkability (Arvidsson et al., 2012; Gebel et al., 2009; Gebel et al., 2011), which contributes to constrained health behaviors and weight gain (Gebel et al., 2011). Previous studies dichotomized the composite walkability score based on the median, tertile, and quartile splits within community settings (Arvidsson et al., 2012; Gebel et al., 2009; Gebel et al., 2011). The studies objectively evaluated neighborhood walkability by taking the highest quartile and lowest quartile or the highest tertile and lowest tertile (Koohsari et al., 2015; Owen et al., 2007). Twenty studies which compared perceived and objective measures were reviewed (Table 1). A common method was to select study neighborhoods using walkability by block groups and calculating concordance and discordance using sample-based median-splits (Arvidsson et al., 2012; Frank et al., 2010; Kamphuis et al., 2010). Some other studies compared perceived and objective presence/absence of destinations (e.g. recreational, PA-related, utilitarian) calculating the rate of agreement and kappa statistics (Caspi, Kawachi, Subramanian, Adamkiewicz, & Sorensen, 2012; Leslie, Sugiyama, Ierodiaconou, & Kremer, 2010). The discrete objective measures and perception measures of environments were then summarized with two-by-two tables to identify concordance and discordance between the two types of measures and to compare the compositions of the agreements and disagreements.

Table 1 Reviews of Studies on Perceived and Objective Walkability Comparisons

References	Study Area	Categorization Methods
Arvidsson et al. (2012)	Sweden	Walkability index was composed of residential density, land use mix, and street connectivity. Sample-based median-splits were used to compare with perceived walkability.
Bailey et al. (2014)	Wisconsin, U.S.	Various neighborhood destinations were objectively measured within 400m buffers, covering five domains. The agreements between perceived and objective access to neighborhood destinations were evaluated.
Ball et al. (2008)	Australia	The presence/absence of 8 PA facilities was objectively measured within 2km. The agreements between perceived and objective proximity to PA facilities were evaluated.
Barnes, Bell, Freedman, Colabianchi, and Liese (2015)	South Carolina, U.S.	The presence/absence of retail food outlets was objectively measured within 1km buffers. The agreements between perceived and objective access to food outlets were evaluated.
Boehmer, Hoehner, Deshpande, Ramirez, and Brownson (2007)	Georgia & Missouri, U.S.	Audits were conducted to measure recreational facilities, land uses, infrastructures, and aesthetics within 400m buffers. Without the discordance measure, logistic regressions of obesity were estimated separately.
Boehmer, Hoehner, Wyrwich, Ramirez, and Brownson (2006)	Georgia & Missouri, U.S.	Audits were conducted to measure recreational facilities, land uses, infrastructures, and aesthetics within 400m buffers. The kappa statistics were used to evaluate the percentage of agreements between survey and audit items.
Caspi et al. (2012)	Massachusetts, U.S.	The presence of supermarkets was objectively measured within 1km buffers. The agreements between perceived and objective proximity to supermarkets were evaluated.
Gebel et al. (2009)	Australia	Walkability was composed of dwelling density, intersection density, land use mix, and net retail area. Measures were converted into deciles, ranging from 1 to 10, and summed across four dimensions. The first and fourth quartiles were selected.
Gebel et al. (2011)	Australia	Follow-up study of Gebel et al. (2009); the same method was used.
Kamphuis et al. (2010)	Netherlands	Aesthetic, design, lack of traffic safety, lack of social safety, and destination features were measured by audits. Summed scores for each domain were dichotomized by a median-split. Perceived neighborhood unattractiveness and lack of safety were regressed on the five domains of objective features.
Kirtland et al. (2003)	South Carolina, U.S.	The presence/absence of destinations and walking/biking paths were measured by survey and objectively. Kappa statistics were used to identify concordance between perceptions and objective measures.
Koohsari et al. (2015)	Australia	Street connectivity and land use mix were identified within 1 mile buffers. Values were categorized into tertiles and matched, selecting the first and third tertiles for both perceived and objective walkability.
Lackey and Kaczynski (2009)	Canada	Perception and objective measures of the presence/absence of parks within 750m were compared.
Leslie et al. (2010)	Australia	NDVIs were measured within 400m buffers. The top 20% and bottom 20% were selected. Perceived greenness measured with a 4-point scale was compared with NDVIs with kappa statistics.
Lin and Moudon (2010)	Washington, U.S.	Grocery stores, schools, and sidewalks were objectively measured within 1km airline buffer (logged length or counts). Logistic regression models were estimated to compare subjective and objective measures.

Table 1 Continued

References	Study Area	Categorization Methods
Ma and Dill (2015)	Oregon, U.S.	Bike environments (off-street bike trails, bike lanes, streets to bike on, and places to bike to) were objectively measured within 1/2mile circular buffers. Models were estimated to compare subjective and objective measures.
Macintyre, Macdonald, and Ellaway (2008)	Scotland	The presence/absence of public green parks was measured within 1/2mile buffers. The agreements between objective and self-reported proximity were evaluated by percentage agreement and kappa statistics.
McCormack, Cerin, Leslie, Du Toit, and Owen (2007)	Australia	Distances to destinations (shops, supermarkets, post offices, libraries, cafés, bus or train stops, parks, bush lands, and sports fields) were measured with five distance interval categories. Walkability was evaluated with intersection density, residential density, and land-use mix.
McGinn, Evenson, Herring, Huston, and Rodriguez (2007)	NC & MS, U.S.	Creating three components (speed, volume, and intersections), exploratory factor analyses of traffic volume, traffic speed, street connectivity, and traffic crashes were conducted. Sample-based median-splits were performed by counties (e.g. >5 crashes / 1,000 inhabitants).
Owen et al. (2007)	Australia	Walkability was measured with residential density, street connectivity, land use mix, and, net retail area. Scores were converted into deciles, scored from 1 to 10, and summed by four dimensions. The first and fourth quartiles were selected.

CHAPTER III

STUDY AREAS AND DATA COLLECTION

Study 1 and Study 2 share study areas and data collection methods for survey data and objectively measured data, which are necessary for testing the hypothesized relationships for each study. Therefore, this chapter describes the study areas and data collection methods used for both studies.

3.1 STUDY AREAS AND POPULATIONS

This study is a cross-sectional study to examine discordance between desired and actual neighborhood environments and its effects on walking behaviors and perceptions of livability across different population groups. For this study, two sub-samples were drawn from the Small Town Walkability (STW) project survey conducted in 2011-2012 and the Neighborhood Environment, Physical Activity, and Quality of Life (NPQ) study survey completed in early 2014. The STW project, funded by the National Institute of Health (1R01HL103478-01A1; PI: Mark Doescher), examined built environmental factors associated with walking behaviors among rural small town residents (Doescher et al., 2014). The NPQ study, funded by Scott & White Healthcare (S&W RGR# 120803; PIs: Samuel N. Forjuoh, Chanam Lee, and Marcia G. Ory), examined health implications of neighborhood safety among residents in four cities located in central Texas (Forjuoh et al., 2017; Ory, Towne, Won, Forjuoh, & Lee, 2016).

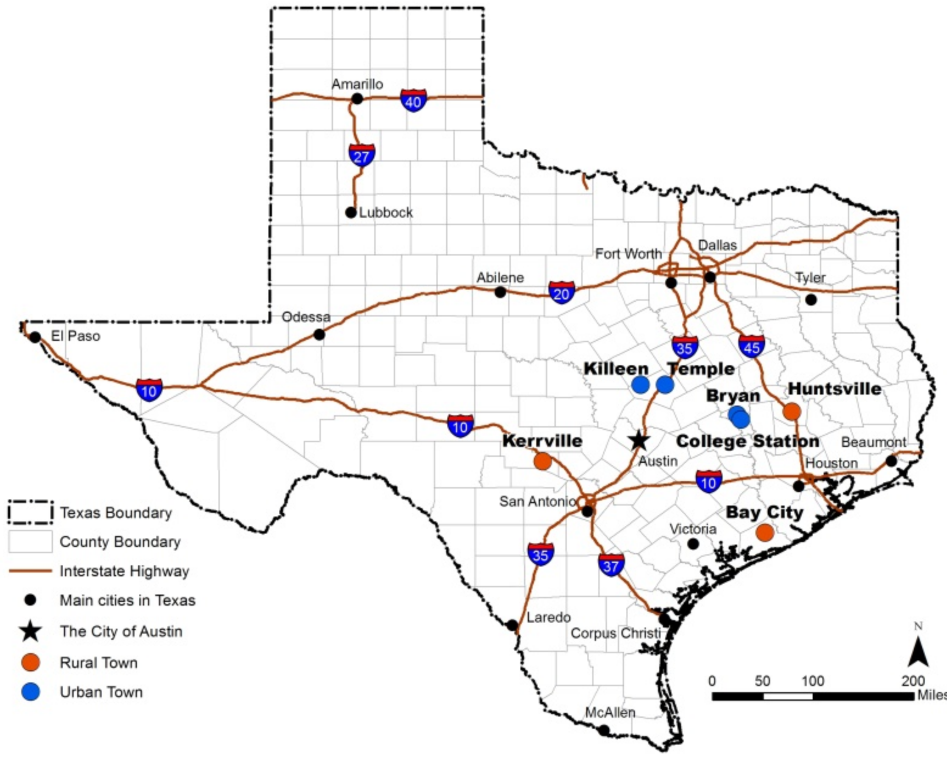

Figure 2 Locations of Study Towns: Four Urban Towns and Three Rural Towns in Texas

A total of 491 respondents were recruited from three rural small towns (STW survey) and 344 respondents from four urban towns (NPQ survey) in non-metropolitan communities, in Texas (Figure 2). The rural towns included Huntsville, Kerrville, and Bay City, while the urban towns were comprised of Temple, Killeen, Bryan, and College Station. All study communities were located in Texas. This dissertation study used single family owner subsamples from those two surveys, and the selected samples were non-students, non-military, non-veterans, and predominantly White non-Hispanic (approximately 90%) residents. The ages of respondents ranged from 50 years to 92 years, and they included those who had no health problems that limited their walking, in both the rural and urban towns. This study employed a sample frame with adult residents of 50 years or older. The middle-aged population was believed to have the capacity to buy homes, seriously consider residential environments (Myers & Gearin, 2001), and attracted growing attention as an age group comparable to the older adult population (65 years and older) in terms of walking behaviors (Dawson, Hillsdon, Boller, & Foster, 2007; Shimura, Sugiyama, Winkler, & Owen, 2012). Geographically, both urban and rural towns were defined in this study as fairly remote from existing large metropolitan areas. Urban towns recruited for the NPQ survey were larger in population size (≥ 50,000) ranging from 70,190 to 137,147 and had more suburban types of development patterns or urban forms with polycentric and/or strip types of commercial developments (Table 2). Rural towns recruited for the STW survey were smaller in size (< 50,000) ranging from 17,509 to 39,795 and had a fairly mono-centric development pattern (U.S. Department of Agriculture, 2013). Both the urban and rural study towns were not relevant to the definitions of exurbs or suburbs, which served as commuter towns (Baldassare, 1992; Hansen et al., 2005).

Among the rural towns, Huntsville, located in Walker County, has the largest population (39,795) and the highest poverty rate (32.0%) (Table 2). Kerrville has the highest proportion of the the older population (26.3%) and is located in Kerr County. Bay City, where many Latino residents live (43.4%), shows the highest home-ownership rate (62.0%), and is located in Matagorda County near the Gulf of Mexico. The towns represent small rural towns with a population density ranging from 1,075 to 2,200 persons per square mile. Among urban towns, College Station's residents have the highest level of education with 93.1% with more than a high school diploma, while the adjacent city of Bryan has the highest rate of Latino residents (36.2%) (Table 2). Both College Station and Bryan are located in Brazos County. Residents in Temple are characterized as having the highest rate of elderly (13.8%), median income ($51,192), and home-ownership rate (59.6%). Killeen has the largest population (137,147) and population under 18 years of age (30.4%). Both Temple and Killeen are located in Bell County. More residents with high incomes, or at or below the poverty level, and with high school diplomas live in urban towns, while more older-adults, Latinos, and home owners reside in rural towns. Those towns include a mixture of suburban and rural development patterns representing a population density ranging from approximately 960 to 2,510 persons per square mile.

Table 2 Socio-demographic Characteristics of Populations in Urban and Rural Towns

	Population (2013)	Age 18- (%)	Age 65+ (%)	Female (%)	Latino (%)	Median household income ($)	Persons below poverty (%)	High school degree (%)	Home ownership rate (%)
Rural Towns:									
Huntsville	39,795	14.0%	8.5%	40.9%	18.7%	$29,524	32.0%	78.9%	37.9%
Kerrville	22,663	19.3%	26.3%	52.5%	27.4%	$38,009	17.3%	86.1%	61.5%
Bay City	17,509	27.9%	12.2%	51.0%	43.4%	$34,941	24.2%	78.3%	62.0%
Urban Towns:									
Temple	70,190	26.4%	13.8%	52.2%	23.7%	$51,192	12.3%	86.8%	59.6%
Killeen	137,147	30.4%	5.2%	51.0%	22.9%	$44,799	16.9%	90.9%	49.6%
Bryan	78,709	25.6%	9.1%	49.8%	36.2%	$37,763	27.4%	77.6%	48.4%
College Station	100,050	14.8%	4.7%	49.2%	14.0%	$30,806	37.5%	93.1%	35.1%
State									
Texas	26,448,193	27.3%	10.3%	50.4%	27.4%	$51,563	17.4%	80.8%	63.9%

U.S. Census Bureau (2013)

According to a relevant population group representing adults of 60 years or older, the population consists of more female and less Hispanic residents with a higher level of median household income and home ownership compared with the total population in those areas (Table 3). Data for the city of Huntsville and Bay City were not available for the population groups (U.S. Census Bureau, 2013). Compared with the relevant population group (≥ 60 years), the study sample represents more female residents with a higher education level (Table 4).

Table 3 Socio-demographic Characteristics of Populations 60 Years Old or Older in Urban and Rural Towns

	Population (2013)	Female (%)	Latino (%)	Mean household income ($)	Persons below poverty (%)	High school degree (%)	Home-ownership rate (%)
Rural Towns:							
Huntsville	4,268	47.9%	-	-	-	-	-
Kerrville	7,388	57.0%	11.8%	55,658	10.5%	84.2%	77.1%
Bay City	3,287	55.9%	-	-	-	-	-
Urban Towns:							
Temple	13,199	55.1%	10.5%	61,434	10.5%	82.2%	68.3%
Killeen	10,918	57.1%	16.5%	44,789	11.3%	82.3%	78.0%
Bryan	10,114	54.8%	15.5%	43,521	12.9%	79.8%	72.2%
College Station	7,144	55.6%	6.2%	107,520	7.9%	91.8%	79.8%
State Texas	3,974,330	54.9%	21.7%	61,916	11.2%	76.9%	80.5%

U.S. Census Bureau (2013)

Table 4 Respondent Characteristics of Rural and Urban Towns

	Sample (Age 50-92) (n (%))	Age 65+ (%)	Female (%)	Latino (%)	$5,0000+ income (%)	<$25,000 Income (%)	High school degree (%)
Rural Towns:	491	58.0%	60.1%	8.4%	59.6%	14.1%	97.4%
Huntsville	162 (33.0%)	56.8%	58.0%	6.8%	69.3%	5.7%	97.5%
Kerrville	174 (35.4%)	71.8%	58.0%	6.9%	53.5%	16.2%	98.9%
Bay City	155 (31.6%)	43.9%	64.5%	11.7%	55.9%	20.6%	95.5%
Urban Towns:	344	50.9%	55.8%	7.6%	71.4%	8.4%	98.0%
Temple	82 (23.8%)	53.7%	59.8%	6.2%	67.5%	7.5%	100.0%
Killeen	107 (31.1%)	45.8%	51.4%	14.2%	65.4%	12.5%	97.2%
Bryan	63 (18.3%)	55.6%	58.7%	6.3%	72.1%	8.2%	95.2%
College Station	92 (26.7%)	51.1%	55.4%	2.2%	81.6%	4.6%	98.9%

3.2 DATA COLLECTION METHODS

3.2.1 Survey Process

The STW survey was a bilingual telephone survey (English and Spanish) administered in 2011 and 2012 (Table 5). The survey instrument was developed based on reliable and validated questionnaires including the International Physical Activity Questionnaire (Craig et al., 2003) and the Walkable and Bikable Communities Survey (Moudon et al., 2006). The questions used in the survey included: demographics, SES, perceived supports and barriers for walking, neighborhood perceptions, activity behaviors, and health status. The samples were selected randomly based on the residential parcels within the sample frame excluding the residences with a very low residential density which involved poor accessibility. Phone numbers were obtained through a reverse directory land line phone look-up for the sample parcels. The response rate was estimated to be 18.8% (Table 5). The NPQ survey was carried out as mail and on-line surveys in 2013-2014. The survey questions were selected using items from the Brazos Valley Health Assessment Survey (Center for Community Health Development, 2010), the Walkable and Bikable Communities Survey (Moudon et al., 2006), and a Behavioral Risk Factor Surveillance System (Centers for Disease Control and Prevention, 2008). The survey questions included demographics, SES, activity behaviors, health status, perceived safety, social disorder, and neighborhood perceptions. With the sample frame for the adults who were 50 years or older, the respondents were recruited by sending a letter of invitation to 1,000 patients in the patient database of the

Scott & White Healthcare system. The response rate of this survey was estimated to be 40.7% (Table 5).

Table 5 Summary of Data Collection Methods of Two Surveys

	Sampling method	Collection method	Survey method	Response rate	Total completed surveys
Small Town Walkability (STW) project	Geographical random sampling	Telephone survey	Phone interview	18.8%	2,156
Neighborhood Environment, Physical Activity, and Quality of Life (NPQ) study	Nonprobability sampling (patient database)	Mail and on-line survey	Self-reported	40.7%	407

3.2.2 Survey Variables

3.2.2.1 Personal and Household Characteristics

Personal and household characteristics variables were collected through two surveys. The variables, which captured the same characteristics, were matched between the NPQ survey and STW survey, and the variables are listed in Table 6. However, some of the variables were measured with different scales (e.g. marital status, household income). Thus, this section describes a list of survey variables and the details to match the different measurement scales (Table 6).

Table 6 A List of Personal and Household Variables Collected by Two Surveys

Category	Variables	Variable scale	
		NPQ survey: urban	STW survey: rural
Personal demographics	Gender	Binary	Binary
	Age ranging 50 – 92 years	Continuous	Continuous
	Ethnicity: Hispanic	Binary	Binary
	Races	5-point categorical	5-point categorical
	Body mass index (BMI)	Continuous	Continuous
	Marital status	3-point categorical	6-point categorical
	Educational attainment	7-point categorical	6-point categorical
	Employment status	4-point categorical	Binary
	Military status	5-point categorical	N/A
	Working hours/week	Continuous	Continuous
	Health condition	5-point categorical	N/A
Personal attitudes/ activities	Housing affordability	Binary	Binary
	Neighborhood attractiveness	Binary	Binary
	Utilitarian walkability	Binary	Binary
	Neighborhood safety	Binary	Binary
	Walking difficulties	5-point categorical	4-point categorical
	PA at work	5-point categorical	4-point categorical
	Someone to walk with	Binary	Binary
	Having exercise equipment	Binary	N/A
	Hours spent in front of screens per week	Continuous	Continuous
	Walking minutes for transportation per week	Continuous	Continuous
	Walking minutes for recreation per week	Continuous	Continuous
Household characteristics	Length of residence (years)	Continuous	Continuous
	Unattended dog in neighborhoods	Binary	N/A
	Number of vehicles	Continuous	Continuous
	Driving days/miles	Continuous	Continuous
	Number of family members	Continuous	NA/
	Number of children in the household	Continuous	Continuous
	Annual household income	7-point categorical	9-point categorical

N/A: unmeasured

The two surveys included questions about residential and household characteristics, demographics and individual characteristics, and health conditions (self-evaluated and anthropometry). Rural residents provided information on age, gender, race, SES, lifestyle, household characteristics, and health conditions. Urban residents also presented information on age, gender, race, SES, lifestyle, household characteristics, and health conditions. Encompassing the personal and household characteristic variables, this study defined three general categories: 1) personal demographics, 2) personal attitudes or activities, and 3) household characteristics. Matching the two surveys, age, gender, ethnicity/races, BMIs, marital status, educational attainment, employment status, and working hours were identified as personal demographic factors (Table 6). The race variables were categorized into a discrete racial factor indicating non-Hispanic White vs. others due to a high portion of the racial group (84.0% in urban towns and 87.2% in rural towns). BMIs, calculated with self-reported heights and weights, were translated into a dichotomy variable at the obesity level (BMI ≥ 30) (Centers for Disease Control and Prevention, 2015). The STW survey asked about six kinds of relationships with a partner/spouse, but the categories could be merged into two types: married or living with a partner vs. others (i.e. divorce, widowed, separated, never married). Employment statuses were dichotomized into the employed for wages or self-employed vs. others (i.e. homemaker, retired, unable to work).

Neighborhood considerations were captured with five kinds of questions: 1) affordable housing, 2) attractiveness of the neighborhood, 3) ease of walking to retails and services and transit, 4) ease of walking to parks or recreation facilities, and 5) neighborhood safety. But, the fourth item, walkability for recreational walking, was not measured by the STW survey. Respondents were asked to select, on a binary scale and multiple-choice options, the important reasons they chose their current residences. Of the four neighborhood consideration items except for the recreational walkability consideration, the variables related to neighborhood utilitarian walkability and safety were used as the key variables in this study based on the conceptual model throughout the whole of this dissertation.

Walking behaviors for all purposes, recreation, and transportation were measured by both the STW and NPQ surveys by asking respondents about the number of days and minutes per day devoted to the activity in a typical week. The minutes per day were multiplied by the number of days to compute the total walking minutes per week. Because of a small portion (ranging from 6.8% to 20.4%) of non-walkers for any purpose and recreation, the walking minutes per week were categorized into two levels of walking: low walkers (0-149 minutes), and high walkers (150 minutes or greater). Owing to a higher portion of non-walkers (83.6% in urban towns and 38.7% in rural towns), transportation-purpose walking was captured with the odds of walking (i.e. walker vs. non-walker) (Moudon et al., 2006). The threshold of 150 minutes was derived from the 2008 Physical Activity Guidelines for Americans recommendation of moderate-intensity physical activity for at least 2 hours and 30 minutes per week (U. S. Department of Health and Human Services, 2008).

Other activity related traits included walking difficulties, physical activity levels at work places, having someone to walk with, and hours spent in front of screens. Many of the respondents (82.0% in urban towns and 91.4% in rural towns) had no trouble in walking for a quarter of a mile at least. The variables were categorized into a dichotomy indicating any difficulty in walking vs. no difficulty. Since a majority of respondents was engaged in sitting at works or had no job (86.6% in urban towns and 73.5% in rural towns), jobs involving standing, walking, and heavy labor vs. sitting or non-work were captured for a variable of physical activity level at work. Someone to walk with and hours on screens were consistent between the two surveys in the measurement scales and were distributed appropriately for analyses (i.e. no small portion of a category, normally distributed).

Household characteristics were comprised of the length of residence, the number of vehicles per person, the number of children, and annual household income. In a screening test, marital status and the number of vehicles per household were moderately correlated with each other (r_s= 0.523, p<0.001), which could result in incorrect statistical estimations since this study was not able to control for the unmeasured family size. Thus, the number of vehicles per household was converted into the number per person considering their marital statuses, dividing by two if a respondent was married. Combining subdivided categories used for the STW survey (e.g. <$10k, $10k-$15k $15k-$25k), household level incomes were sorted out to include a 7-point scale: less than $25k (coded as 1), $25k-$34.9k (2), $35k-$49.9k (3), $50k-$74.9k (4), $75k-$99.9k (5), $100k-$149.9k (6), and $150k or more. Due to unmeasured variables from one of the two surveys, several variables were not included in further analyses (e.g. driving miles, family sizes).

3.2.2.2 Perception of Environments and Perception of Safety

On the basis of previous literature on measurement frameworks (Lee & Moudon, 2004; Moudon & Lee, 2003; Saelens, Sallis, & Frank, 2003), the two surveys measured perceptions of environmental attributes. For measures of perceived environments, environmental variables collected by the surveys included perceived supports and barriers and neighborhood perceptions measured with a binary scale in rural small towns. Environmental perceptions measured in urban towns using a 4-point Likert scale from strongly disagree to strongly agree were categorized into neighborhood safety, social disorder, neighborhood perceptions, and neighborhood attractiveness. Thus, candidate subjective variables were identified based on the hypotheses of this study: 1) built environmental supports and barriers, 2) social environmental supports and barriers, and 3) neighborhood perceptions in both rural and urban towns. Addressing various aspects of perceptions of built and social environments (e.g. attractiveness, social interactions, injury risks) was not possible, because of limited measures of perceived environments by the STW survey (11 items compared to 49 items from the NPQ survey) (Table 7).

Out of the measured variables, nine were available to be compared, and the variables are listed in Table 7. Reviewing the variables, the perception measures converged on perceptions related to pedestrian infrastructure availability and conditions, traffic conditions, and surveillance. The characteristics were accommodated into walking-related safety features (Alfonzo et al., 2008; Foster & Giles-Corti, 2008). According to existing literature, safety-related correlates of walking could be summarized with traffic-related safety, crime-related safety, and walking-related safety (Bracy et al., 2014; Foster & Giles-Corti, 2008; Saelens, Sallis, Black, & Chen, 2003). Thus, this study employed nine perceived environmental factors with three dimensions: perceived safety from traffic, perceived safety from crime, and perceived safety for walking. Perception items captured with a 4-point Likert scale by the NPQ survey were split into agreements with high safety vs. disagreements. In addition, two neighborhood perception items, 1) my neighborhood is a good place to live and 2) my neighborhood is a good place to raise children, were utilized to capture perceived livability for Study 2 (Chapter V).

Table 7 A List of Safety Perception Variables Collected by Two Surveys

Dimension	NPQ survey: urban	Scale	STW survey: rural	Scale
Traffic	There is so much traffic along the street I live on that it makes it difficult or unpleasant to walk in my neighborhood. There is so much traffic along nearby streets that it makes it difficult or unpleasant to walk in my neighborhood.	4-point Likert	There is so much traffic along nearby streets that it makes it difficult or unpleasant to walk in my neighborhood.	Binary
	There are crosswalks and pedestrian signals to help walkers cross busy streets in my neighborhood. The crosswalks in my neighborhood help walkers feel safe crossing busy streets.		There are crosswalks and pedestrian signals.	
	The speed of traffic on the street I live on is usually slow (30 mph or less) in my neighborhood. The speed of traffic on nearby streets is usually slow (30 mph or less) in my neighborhood.		The speed of traffic on most nearby streets is usually slow.	
Crime	My neighborhood streets are well lit at night.		Neighborhood is well lit at night.	
	Many people walk or bike in my neighborhood.		Many people walk in my neighborhood.	
	My neighbors could be counted on to help in case of need.		My neighbors could be counted on to help in case of need.	
Walking	There are sidewalks or protected walkways (e.g., trails) in my neighborhood.		There are sidewalks and shoulders where people can walk.	
	There are NOT many broken sidewalks in my neighborhood		NOT Inadequate sidewalks or shoulders on the road	
	There are many stray dogs in my neighborhood.		Unattended dogs are a problem in my neighborhood.	

3.2.3 Objectively Measured Built and Social Environmental Attributes

Environmental attributes included in this study were chosen based on the previous literature (Lee & Moudon, 2004; Moudon & Lee, 2003; Saelens, Sallis, Black, et al., 2003) and conceptualized in Figure 1 (Chapter I). The attributes are listed in Table 8. The attributes of built and social environments were measured objectively based on respondents' home locations within 1km circular and sausage network buffers as an approximate maximum distance accessible by walking to neighborhood destinations (Algert, Agrawal, & Lewis, 2006; Witten, Pearce, & Day, 2011). The sausage network buffer technique is a recently developed method to create street and pedestrian networks which can be replicable across software and provides constant results (Forsyth, Van Riper, Larson, Wall, & Neumark-Sztainer, 2012). A unique feature of this method is that the network buffers are generated with a sausage-like shape having rounded buffers with X-meters radius. For the radius, 100m were used for this study (Figure 3).

Objective measures identified for this study captured seven general categories: 1) transportation and pedestrian infrastructures, 2) natural environment, 3) safety-related risks, 4) generalized land uses, 5) neighborhood destinations, 6) residential and employment densities, and 7) regional home locations. The geographical locations of respondents' homes were identified with the addresses provided from surveys and with geocoding the addresses using ArcGIS 10.0 (Esri, Redlands, CA). Raw GIS data necessary to capture objective measures of built and social environmental variables were obtained from the County Tax Assessor's offices, the GIS and Police Departments of each city, Texas and local Departments of Transportation, and the Texas Department of

Public Safety. Some of the data were already digitized or geocoded into GIS (e.g. crashes, destinations), but it was necessary to digitize or geocode crime, railroads, and crosswalks. All raw data were requested and acquired within years relevant to collecting the survey data (2013-14 for urban towns and 2011-12 for rural towns) (Table 8).

Figure 3 An Example of Sausage Buffer

Table 8 A List of Objectively Measured Environmental Variables

Domains	Subdomains	Environment items	Relevant environmental measures
Transportation and pedestrian infrastructures	Traffic controls	Crosswalks	The number/presence of crosswalks within a home buffer
	Roadways	Intersections	Intersection densities within a home buffer
		Street networks	The length of major streets (inter-city throughways and inter-neighborhood arterials) within a home buffer
			The length of streets except for highways within a home buffer
		Sidewalks	Sidewalk completeness within a home buffer
		Highways	The length/presence of highways within a home buffer
	Transits	Railroads	The length/presence of railroads within a home buffer
Natural environment	Greenery	Normalized Difference Vegetation Index (NDVI)	The mean of NDVI within a home buffer
Safety-related risks	Crimes	Violent crimes	Density of incidents including murder, sexual offense, robbery, and aggravated assault within a home buffer
		Property crimes	Density of incidents including burglary, larceny-theft, motor vehicle theft, and arson within a home buffer
		Behavioral crimes	Density of incidents including disorderly conduct, drug abuse/seize/alcohol, weapon arrests, driving under the influence, and kidnapping within a home buffer
		Total crimes	Density of incidents including violent crime, property crime, and behavioral crime within a home buffer
		Sex offenders	Density of sex offenders within a home buffer
	Crashes	Pedestrian crashes	Density of pedestrian crashes within a home buffer
		Cyclist crashes	Density of cyclist crashes within a home buffer
		Vehicle crashes	Density of vehicle crashes within a home buffer
Generalized land uses	Generalized land uses	Residential, single family uses	The % of single family residential areas per km^2 within a home buffer
		Residential, multi-family uses	The % of multi-family residential areas per km^2 within a home buffer
		Industrial uses	The presence of industrial area within a home buffer
		Park and recreational uses	The presence of cultural, entertainment and recreational areas within a home buffer
		Agricultural uses	The % of resource production and extraction areas per km^2 within a home buffer
		Civic uses	The presence of transportation, communication and utility areas within a home buffer
		Commercial uses	The % of commercial areas per km^2 within a home buffer
		Undeveloped and water lands	The % of undeveloped and water areas per km^2 within a home buffer

Table 8 Continued

Domains	Subdomains	Environment items	Relevant environmental measures
Neighborhood destinations	Food stores	Supermarkets Warehouse centers Grocery stores Ethnic markets Specialty food stores Convenience stores	Total number of food stores within a home buffer
	Food services	Ethnic restaurants Traditional restaurants Fast food restaurants Ethnic quick services Quick services Snack and non-alcoholic beverage stores Coffee shops Dessert stores Bars/taverns/pubs	Total number of food services within a home buffer
	Drug stores and video services	Drug stores Video stores	Total number of drug store/video services within a home buffer
	Shopping malls	Shopping malls	The presence of a mall within a home buffer
	Services	Post offices Banks Religious institutions Daycare services	Total number of service destinations within a home buffer
	Community services	Park and open spaces Fitness center/recreation facility	Total number of community service destinations within a home buffer
	Educational services	University/public/private schools	Total number of educational service destinations within a home buffer
Densities	Residential	Single family residential units Multi-family residential units	Density of residential units within a home buffer
	Employment	Large business (≥100 employees) Employees in large business	Density of large businesses within a home buffer Density of employments within a home buffer
Regional locations	Distance to CBD	Distance to city halls	Distance to city halls (km)

3.2.3.1 Transportation and Pedestrian Infrastructures

The transportation and pedestrian infrastructures included measures of crosswalks, sidewalks, street networks, highways, and railroads which were related to facilitators and barriers to walking (Lee & Moudon, 2006a). Raw GIS data for this domain were collected from the County Tax Assessor's offices, GIS Departments, and state and local Departments of Transportation of each city. Using the raw data, essential variables for further analyses were prepared including sidewalk completeness, pedestrian network completeness, the number of crosswalks, intersection density, and the presence of highways and railroads.

The location points of crosswalks were identified by data received from local transportation departments, compared with aerial photos, and were reviewed and adjusted with correct locations. The number of crosswalks was counted within the circular and network home buffers. Street network data obtained from the Texas Department of Transportation (TxDOT) involved the roadway classification codes indicating highways, inter-city throughways, inter-neighborhood arterials, and local streets. Pedestrian networks were captured with all roadways excluding only highways as a supplemental measure, because of a lower rate of streets covered by sidewalks in rural towns (citywide 23.5% in rural towns vs. 37.8% in urban towns), considering the fact that many of the local streets with no sidewalks were utilized for walking in such towns (Doescher et al., 2014). Major streets, which were a compound of inter-city throughways and arterials, were used for calculating the sidewalk completeness. The sidewalk completeness is the ratio of the total length of sidewalks to the total length of major streets within home buffers. In the case of sidewalks covering one of two roadsides, half of their length was used for the calculations (Zhu & Lee, 2008). Because of the low coverage by sidewalks in rural towns, the local streets were excluded from the calculations. A raw polyline data of sidewalks were also received from local Departments of Transportation. With the street network data, intersection location points were extracted using the Network Analyst tool in ArcGIS, and the number of intersections was divided by the total length of pedestrian networks within home buffers in order to measure the intersection density (Frank et al., 2010). The total lengths and presences of railroads and highways were gauged with raw data which were obtained from the County Tax Assessor's offices or local GIS Departments, or digitized using aerial photos.

3.2.3.2 Natural Environment: Greenery

A measure of natural environments was the normalized difference vegetation index (NDVI) which was created from the National Agriculture Imagery Program (NAIP) imagery administrated by the Farm Service Agency (FSA) of the U.S. Department of Agriculture (USDA). The NDVIs can simply indicate the quantified density of green vegetation (Jensen, 2005). The NDVIs are determined by taking the ratio of visible wavelengths (red band) and near infrared (NIR band) wavelengths of sunlight reflected by the objects or plants. A calculation of NDVI per pixel ranges from -1 to +1. A higher value close to +1 indicates the highest intensity of green vegetation attributed to a large difference between the reflected wavelengths embodied by NIR bands and the absorbed wavelengths represented by red bands. A zero value of NDVI indicates no vegetation. For this study, the mean of the NDVIs per pixel within home buffers was calculated using the NAIP imageries captured with 1×1m pixels in 2012 and 2014. The calculations were performed with the following formula:

$$NDVI = \frac{Band\ 4\ (near\ infrared\ (NIR)) - Band\ 3\ (red)}{Band\ 4\ \big(near\ infrared\ (NIR)\big) + Band\ 3\ (red)}$$

This formula produces a value that ranges from -1 (usually water) to +1 (highest vegetative intensity) (Figure 4).

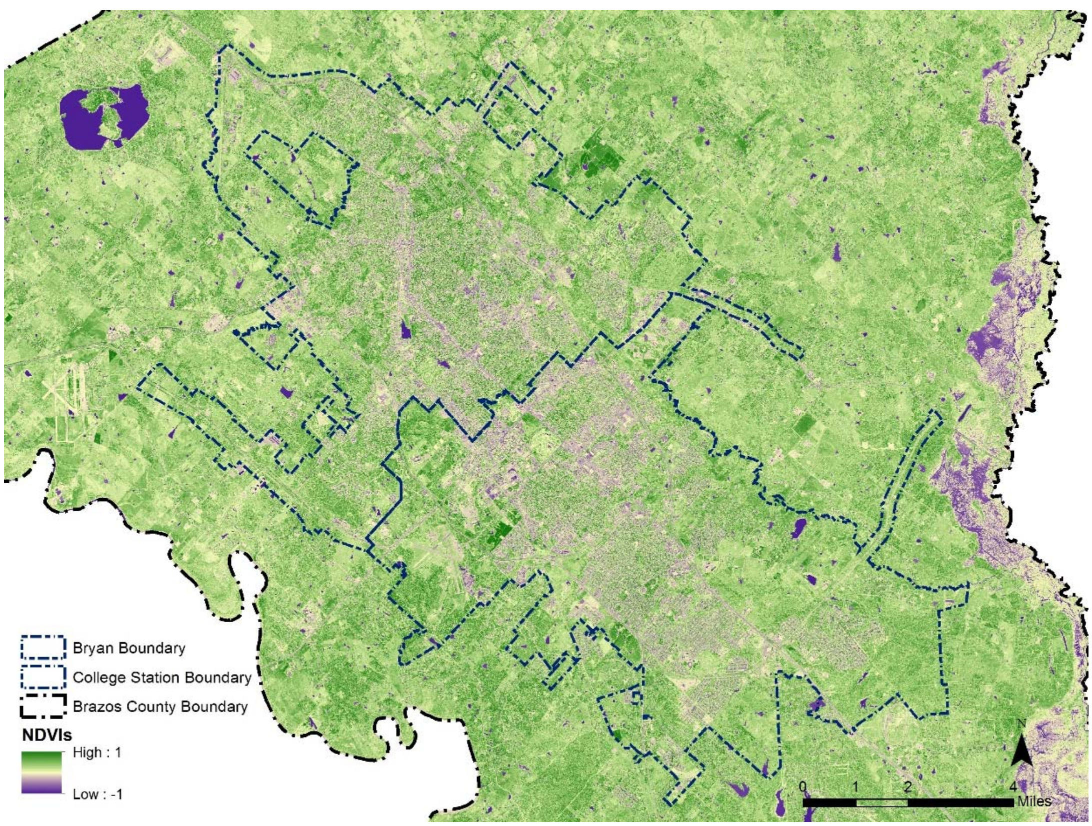

Figure 4 An Example of an NDIV Map of Brazos County

3.2.3.3 Safety-related Risks: Crime and Crash Incidents

Raw data of crime incidents were collected from the local Police Departments of each city and provided records of all 911 calls including information on types of call, street address and ZIP codes, and X and Y coordinates. Excluding irrelevant calls (e.g. family crimes, financial crimes, missing) to the conceptual framework of this study, a classification frame for crime incidents was developed based on the eight serious Crime Index offenses in the Texas Uniform Crime Reporting (UCR) program: murder, rape, robbery, aggravated assault, burglary, larceny-theft, motor vehicle theft, and arson (Texas Department of Public Safety, 2014). All relevant items were classified into three general categories: 1) violent crime, 2) property crime, and 3) behavioral crime. The relevant items are listed in Table 9. Using 2008-2013 (6 years) crime records from urban towns and 2006-2012 (7 years) records from rural towns, locations of crime incidents were geocoded using GIS and the mean numbers of crime incidents were counted within home buffers. Due to a large variation in the number between cities and years, the numbers were then transformed into densities of yearly average numbers of crime incidents within buffers. However, one of three rural towns, Bay City, had a limited system in which to store a large number of cumulative records. Since only two years of data obtained from this city were insufficient and unusable to capture safety risks at neighborhood levels due to variations between years, the city and 155 observations recruited from the city were excluded from further analyses (Table 9).

Raw data of crash incidents for all urban and rural towns were obtained from the TxDOT. Pedestrian- or cyclist-involved crashes were available for all years from 2006 to

2014, but vehicle involved crashes were only offered for 5 years from 2010 to 2014. Thus, 2006-2014 (9 years) crash records of pedestrians and cyclists and 2010-2014 (5 years) records of vehicle crashes were utilized for the urban subsample, while 2006-2012 (7 years) crash data relevant to pedestrians or cyclists and 2010-2012 (3 years) data for vehicle crashes were adopted for the rural subsample. The raw crash data which were already geocoded by TxDOT were captured within home buffers to count the number of crashes. The numbers of crashes were also translated into the density of yearly average numbers of crash incidents within home buffers, to adjust for variations between towns and years.

Table 9 A Classification of Crime Incidents

Classifications	Offenses
1) Violent crime	
Murder	Murder, deadly conduct, and attempted murder
Sexual offense	Sexual assault, forcible rape, and indecency with a child
Robbery	Robbery
Aggravated assault	Assault and aggravated assault
2) Property crime	
Burglary	Burglary – building, coin machine, and habitat
Larceny-theft	Credit/debit card abuse, ID theft, and other thefts
Motor vehicle theft	Burglary – vehicle
Arson	Arson
3) Behavioral crime	
DOC	Disorderly conduct, criminal mischief, criminal trespassing, graffiti, etc.
Drug abuse/seize/alcohol	Possession of marijuana or other drugs and illegal/minor alcohol consumption
Weapon arrest	Possession of an implement of a crime and weapons violation
DUI	Driving under the influence and driving while intoxicated
Kidnapping	Kidnapping

3.2.3.4 Generalized Land Uses

Parcel data and land use codes were the basis for generalized land use data at a parcel level. The raw data were offered by the local GIS Departments and each County Tax Assessor's offices. Parcel data matching with land use codes by property IDs were classified into eight types of generalized land uses: 1) residential, single family uses, 2) residential, multi-family uses, 3) commercial uses, 4) industrial uses, 5) civic uses, 6) agricultural uses, 7) park or recreational uses, and 8) undeveloped and water lands. Of the land uses, residential, commercial, and industrial uses merely followed the existing classifications. Civic uses included companies for transportation, communication, and utilities, utility lines, and airports. Agricultural uses comprised natural resources, orchards, farmlands, and ranches. Park or recreational uses were namely parks and open spaces, and the undeveloped and water lands were related to vacant lands, timberlands, and riparian areas. The parcel unit data were captured with areas (km^2) which were devoted to a single land use within home buffers. By land use classifications, the areas were calculated into the ratio of areas for a single land uses to the total areas of all land uses.

3.2.3.5 Neighborhood Destinations

First, a classification scheme for neighborhood destinations was developed based on searches from the North American Industry Classification System (NAICS) codes, which are widely used as a standard for classifying business establishments in analyzing business data (Office of Management and Budget, 2017). For the purpose of this study, major sorts of neighborhood destinations were selected to review those related to local accessibility identified by previous studies (Forsyth, Hearst, Oakes, & Schmitz, 2008; Powell, Slater, Chaloupka, & Harper, 2006). The identified destinations and their classifications are summarized in Table 10. For information on the name of businesses, locations, and NAICS codes, ReferenceUSA which is a large and extensive database system was available to identify individual businesses linked to target destinations identified from the NAICS search (ReferenceUSA, 2011). For the location information, ReferenceUSA provided X and Y coordinates. Neighborhood destinations were classified into several general categories such as food stores, food services, service destinations, and community service destinations.

Food stores encompassed supermarkets or warehouse centers, small grocery stores, and convenience stores. Big boxes such as supermarkets and warehouse centers located in large sites were measured with their location using a parcel unit. Point locations of the businesses obtained from RefereceUSA were matched with parcels where the points were positioned. Other retail food stores and convenience stores were captured with point data. Food services included all regular types of restaurants (e.g. traditional, ethnic restaurants), fast food restaurants, pizza places, and snack/drink places (e.g. snack places, coffee shops, pubs). Drugstores and video rental stores were included as other interesting destinations which were frequently accessed by walking (Handy et al., 2006). A shopping mall was one of the destinations which were important in both regional and local accessibilities (Handy & Clifton, 2001). This complex-type destination was also measured with a parcel unit. Locations of service destinations (e.g. post offices, banks, daycare services) and community services (e.g. recreational facilities, parks) were collected with point or parcel data. For educational services (e.g. universities, schools), information on all the public and private elementary, middle, high, as well as post-secondary schools was obtained from the National Center for Education Statistics (NCES). Universities and community colleges were identified by manually reviewing aerial photos. Using the information on X and Y coordinates, parcels where the universities or schools were situated were used as units of analyses. Both 1km circular and network buffers were created from respondents' home locations to judge access to destinations with parcel and point units (Table 10).

Table 10 A Classification Schemes for Neighborhood Destinations

General categories	Categories	Destinations	Measurement Type
Food stores	Supermarkets/ Warehouse centers	Supermarkets	Parcel
		Warehouse centers	Parcel
	Retail food stores	Grocery stores	Point
		Ethnic markets	Point
		Specialty food stores	Point
	Convenience stores	Convenience stores	Point
Food services	Restaurants (except fast-food)	Ethnic restaurants	Point
		Traditional restaurants	Point
		Ethnic quick services	Point
		Quick services	Point
	Fast food restaurants	Fast food restaurants	Point
	Pizza places	Pizza places	Point
	Snack and drink places	Snacks and non-alcoholic beverages stores	Point
		Coffee shops	Point
		Dessert stores	Point
		Bar/tavern/pub	Point
Drugstores and video rental stores		Drugstores	Point
		Video stores/rental stores (including Redbox)	Point
Shopping malls		Shopping malls	Parcel
Services, community, and education	Service destinations	Post offices	Point
		Banks	Point
		ATMs	Point
		Religious institutions	Point
		Daycare services	Point
	Community service destinations	Fitness centers/recreational facilities	Point
		Parks	Parcel
	Educational service destinations	Universities, public, and private schools	Parcel

3.2.3.6 Residential Density and Employment Density

Residential density was measured with densities of single family and/or multifamily housing units. The numbers of total housing units within buffers were calculated using the 2013 American Community Survey (ACS) data at the block group level obtained from the U.S. Census Bureau (U.S. Census Bureau, 2013). The numbers of housing units were allocated using the ratio of the area within a home buffer to the total area of the block group. For example, given that a home buffer intersected with 70% of a block group which had 100 housing units, 70 units were assigned to the home buffer. If 130 units were given to the home buffer from other block groups, the total units within the home buffer were 200. To distinguish units of single family and multifamily housings, the numbers of single family parcels were subtracted from the total housing units allocated from block groups. The remaining units out of the total were equal to the number of multifamily housing units. In some cases, if the subtracted number of units was overestimated or underestimated compared to the number of multifamily parcels, the biased estimations were corrected by manually counting actually occupied numbers of single family parcels based on an aerial photo. The numbers of single family, multifamily, and total housing units captured within home buffers were translated into densities of housing units which were a common measure for walking and travel behavior studies (Ewing & Cervero, 2001). In these estimations, net residential densities were considered by utilizing only residential areas within block groups (Frank et al., 2010).

To capture employment density, the number of parcels with large businesses (≥ 100 employees) and the number of employees from the large businesses were adopted as its measures (Moudon, Sohn, Kavage, & Mabry, 2011). The numbers of employers and employees were obtained from the ArcGIS 2015 Business Analyst extension which possessed more accurate information on the sizes of employment. The large businesses which employed 100 people or greater included sites like universities, military bases, shopping centers, supermarkets, hospitals, and government offices. Locations of the businesses were recognized on a parcel basis, since these measures aimed to capture a facet of urban form with a higher density, unlike destination measures to capture proximity to location points (Moudon et al., 2011). This study determined the number of employees engaged at universities whose buildings and campuses were situated in different places, by contacting the Office of Human Resources of each university. Several incorrectly geocoded businesses on streets were collected by manually finding the corresponding parcels where they should be. The number of large businesses and their employees was divided by the area of home buffers to compute densities of employment.

3.2.3.7 Regional Home Locations and Environmental Chances after Move-in

The regional home location was an important factor which was a determinant of macro environments around residences or their subdivisions. Locations of downtowns can be determined considering the clustered locations of major businesses and government offices and employment densities (Sallis et al., 2009). However, one of the study towns, College Station, had no distinct business cluster in areas with a high density. Thus, the locations of Central Business Districts (CBDs) were designated at the positions of city halls for consistency. Using the Network Analyst tool in GIS, street network distances from respondents' home locations to city halls were gauged using a kilometer unit (Figure 5).

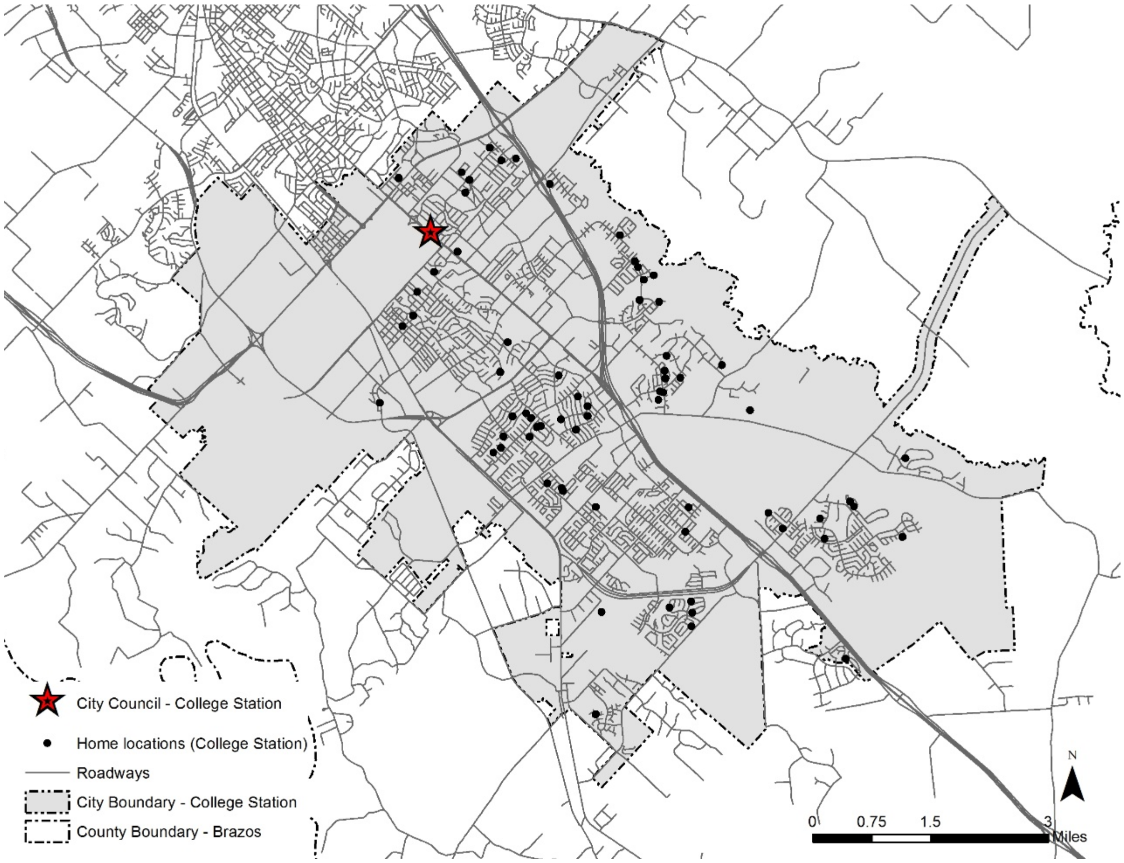

Figure 5 An Example of Locations of College Station Council and Respondents' Home Locations

The conceptual framework of this dissertation study contained, to a certain degree, an awkward match between neighborhood preferences considered when selecting residences and recently measured environmental quality. However, in practice, it is nearly impossible to measure environmental conditions across all different move-in years. Thus, to cover the time gaps, this study created a couple of proxy measures based on the length of residence captured by surveys and objectively measured parcel data. Comparing the move-in years reported from surveys and the years when parcels within 1km of home locations were redeveloped after the move-in years, the percentages of these parcels and areas was determined. These measures were tested to be a proxy ruling out the influences of environmental changes over time. Missing responses in the move-in years were imputed with years shown in the deed history.

3.2.4 Sample Adjustments

This dissertation study employed two different survey data which were collected using different survey methods (i.e. phone vs. mail/online) and sampling methods (i.e. random sampling based on residential parcels vs. nonprobability sampling based on a hospital's patient database). Screening home locations of respondents found that a decent number of urban respondents drawn from the patient database (NPQ survey) were located out of city limits and in rural parts of the urban towns inappropriate to examining walking and daily activities (Towne et al., 2016). To alleviate potential problems, a sample frame of the NPQ survey data were adjusted to correct biases corresponding to the sample frame of the STW survey. For the STW survey, its sample frame was established by selecting the census blocks until the cumulative population reached 80% of the city town population within the city boundaries. The top 80% threshold was used in the rural towns due to their concentric development patterns and lack of access to destinations if living in the bottom 20% areas (Lee, Moudon, & Courbois, 2006). The rural study towns were selected based on the following criteria: enough population size (≥10,000) to accommodate businesses and services which were accessible from residential areas and having diversity in terms of socioeconomic factors (Doescher et al., 2014).

To adjust the sample frame of the NQP survey data, therefore, census blocks were ranked by their populations based on 2010 census data, and then blocks with the highest populations were selected until their sum reached 80% of the city population.

But in urban towns, land use patterns might be different from those in rural towns and even in the bottom 20% areas. There might be sufficient access to destination land uses. After identifying census blocks with 80% of the city population and blocks with 20% of the population, the means of total destinations and the mean rates of residential land uses and commercial land uses in that total block area were compared in low-density and high-density blocks, to confirm differences in accessibility between the two kinds of block groups. There was no difference in the mean rates of residential and commercial land uses, but a difference was found in the mean number of destinations using ANOVA ($F=4.082$ $p=0.044$). In addition, some homes out of city limits were closely located to the city limits. To eliminate potential errors in geocoding home locations (e.g. a unit of apartment complexes geocoded on streets) and city boundary lines (not exactly identical to census block lines), six home locations (within 500 feet of the city limits) were manually identified using aerial photos to see whether they were actually located within the city boundaries or not. Their communities were detached from other communities or commercial services by highways or arterials (Doescher et al., 2014). Thus, only respondents in census blocks in/intersecting city limits were included in the urban subsample. Eventually, a total of 294 respondents were included in the urban subsample. Furthermore, as described earlier, crime incident data were not available from a local government, Bay City, although all other data were acquired. After excluding the respondents recruited from Bay City, a total of 336 respondents remained for the rural subsample.

CHAPTER IV

STUDY ONE: RESIDENTIAL DEMANDS FOR NEIGHBORHOOD WALKABILITY AND SAFETY ACROSS COMMUNITY SETTINGS AND AGE GROUPS

4.1 CHAPTER SUMMARY

A body of evidence has demonstrated that walking-oriented community settings, which are composed of compact development, mixed land use intensity and diversity, and direct street connections, provide many benefits in environmental, social, and health aspects. However, it is still questionable to what extent the typical walking-oriented community setting accords with various housing demands. There is also a shortage of studies examining the interrelationships between objectively evaluated neighborhood quality and preferences for walkable and safe neighborhoods, which are considered in actual residential location choices.

This study examined variations in residential preferences for walkability and safety by personal or household traits and community settings, and environmental features chosen based on preferences across different populations. It used the datasets from two recently completed research projects, both carried out in non-metropolitan communities in Texas. Study towns included four urban towns with populations ranging from 70,190 to 137,147 and two rural towns with populations ranging from 22,663 to 39,795. Activity and personal data were collected via surveys, and built environment and incident data were reproduced by using GIS measured within a 1km sausage buffer from each respondent's home. Bivariate and multivariate binomial logistic regression models were estimated to identify significant personal and environmental correlates of walkability and safety considerations at a significance level of 0.05. All analyses were conducted across the total sample, and urban, rural, older (≥65 years), and middle-aged (50-64 years) subsamples.

In the total sample, Whites residents (-), safety consideration (+), walking for transportation (+), length of residence (+), and proximity to CBDs (+) were personal/household predictors of walkability consideration, while housing affordability consideration (+), neighborhood attractiveness consideration (+), walking for transportation (+), length of residence (-), and rural living (+) were predictors for safety consideration. Perceived safety from traffic (+), food stores (+), and shopping malls (+) were environmental correlates of walkability, while park/recreational space (-) and food stores (-) were correlates for safety.

Findings from the subsample analyses were similar between the rural and older subsamples, and between the urban and middle-aged subsamples. Among rural and older residents, proponents of walkability were healthier, more active, and had a lower SES, while safety proponents were engaged in more walking as well as less sedentary activities. Among urban and middle-aged residents, race/ethnicity and raising children were correlates of neighborhood considerations. Unique environmental correlates were found by subsamples (U refers to urban, R for rural, O for older, M for middle-aged) including: perceived safety for walking (R, M), single family residences (O), industrial land uses (U, O), civic land uses (M), food services (R, M), and educational services (U) for walkability; and perceived safety from traffic and for walking (U), green/vacant spaces (U), single family residences (R), multifamily residences (M), food services (U), and service destinations (R) for safety.

The findings of this study present useful information on housing markets where various groups of customers value different environmental features when purchasing homes placing importance on neighborhood walkability and safety. These suggest that approaches to policies and differential marketing strategies should be tailored to locational and design to meet varying demands.

4.2 INTRODUCTION

In an effort to reduce problems raised by automobile dependency and find alternatives to suburban developments, there has been a consensus that walking-oriented community settings, which are characterized by a compact development, mixed land use intensity and diversity, and direct street connections, provide many benefits in environmental, social, and health aspects (Booth, Pinkston, & Poston, 2005; Ewing, Bartholomew, Winkelman, Walters, & Chen, 2007; Handy, 2005; Saelens & Handy, 2008; Sturm & Cohen, 2004). However, it is still questionable to what extent the typical walking-oriented community setting accords with various housing demands. To encourage the development of walkable communities, it is important to identify whether the general public is actually willing to live in and is likely to be satisfied with life in such communities. Even though some studies have attempted to show evidence that the benefits from this type of development are supported to some extent by the general public (Handy et al., 2008; Myers & Gearin, 2001), the nature of support may merely reflect the collective public attitude. Another group of studies matched types of current communities and the attitudes of residents for the purpose of examining neighborhood type discordances which constrained desired behaviors. The community types were characterized as traditional urban towns with high-density and suburban towns with moderate or low density, and neighborhood preferences were captured by stated preference survey questions for desired neighborhood types (Frank et al., 2007; Schwanen & Mokhtarian, 2005b). Even though the studies addressed the interrelationships between desirable and current neighborhood types, the measurements of stated preferences for neighborhood types were to capture the attitudes which respondents currently possessed. It might be misleading to conclude that the current preferences of residents are related to neighborhood choices. Therefore, it is not guaranteed that these collective attitudes and stated-preferences are actually translated into residential location choices (neighborhood choices) made by individuals (Handy et al., 2008).

Residential preferences, housing demands, and perceptions and evaluation of residential environments are getting more diversified across individuals. Residential choices result from optimizing a verity of demands and preferences of individuals among possible environmental alternatives in terms of dwelling and neighborhoods (Boumeester, 2011; Ge & Hokao, 2006). To identify the nature and extent of the demand for walkable neighborhoods, exploring the specific factors (personal and environmental) associated with neighborhood preference, as a key factor leading to neighborhood choice, will be a prerequisite. Understanding how certain preferred environmental attributes differ by personal or household traits can also be valuable in proposing specific development patterns to effectively support the preferences of different resident groups. A few studies attempted to compare residential self-selection considerations (neighborhood considerations) and current neighborhood environments capturing collective perceptions and objective evaluations of walkability (Van Dyck, Cardon, Deforche, Owen, et al., 2011; Yu & Zhu, 2015). The studies reported mixed implications of objective and perceived measures in matching with neighborhood walkability consideration. Neighborhood walkability consideration was positively associated with perceived neighborhood walkability, while not significantly associated with objective walkability. These studies contained limitations in explaining how various personal and household factors interact with the predispositions toward neighborhood environments. Furthermore, it is not understood what specific environmental features are involved in neighborhood choices based on walkability preferences which can vary with diverse demands.

Therefore, there is a research gap in examining the interrelationships between the objectively evaluated neighborhood quality and preferences for safe and walkable neighborhoods, which are considered in actual residential location choices. This study aims to identify residential demands for walkability and safety, and their variations by personal or household traits and community settings. Further, it aims to examine environmental attributes which undergird the residential preferences of various populations when considering the choice of walkable and safe neighborhoods.

4.3 CONCEPTUAL FRAMEWORK AND AIMS

This study aims to 1) identify who consider walkability or safety when choosing their neighborhood; and 2) examine what objectively measured environmental features exist in the neighborhood chosen by those who prefer walkability or safety for residential choices, and examine how such features chosen by those who consider neighborhood walkability or safety differ in various groups of residents. The conceptual framework of this study included relationships where neighborhood considerations were predicted by personal, household, or locational characteristics and where perceptions of safety and objectively measured environmental factors were correlated with walkability or safety consideration, controlling for confounding factors (Figure 6).

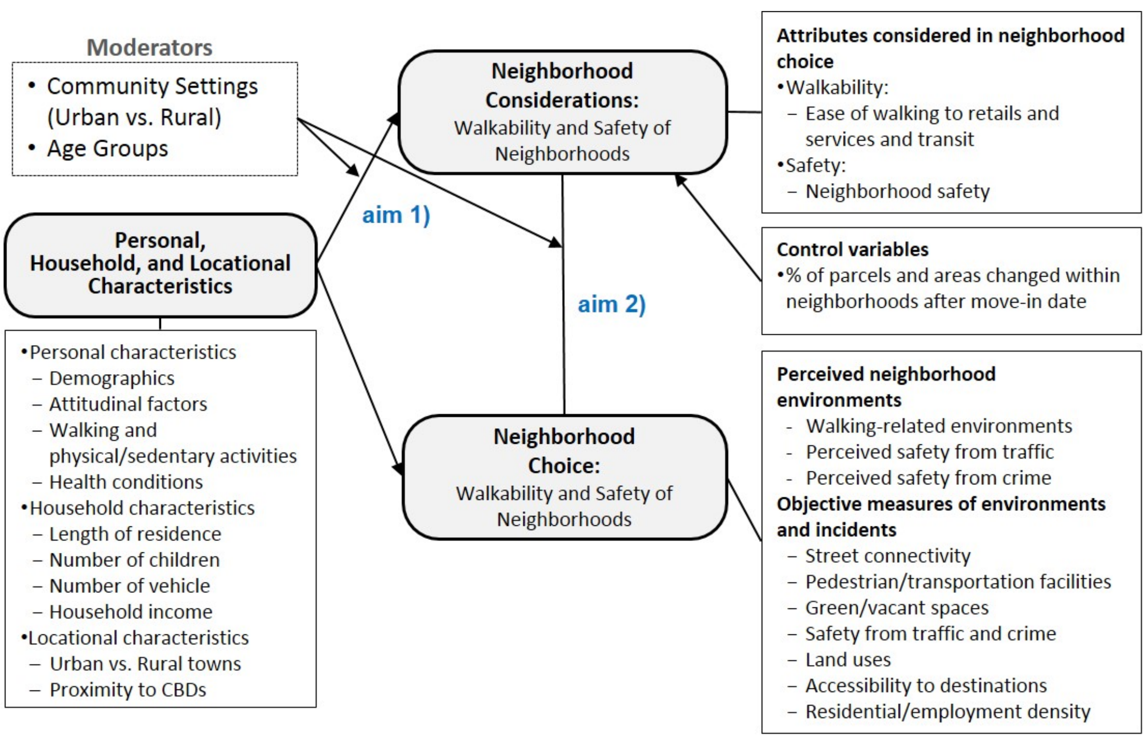

Figure 6 A Conceptual Framework for Study 1

The relationships depicted in the conceptual framework were tested based on the following hypotheses:

Hypothesis 1. Personal, household, or locational predictors of neighborhood quality consideration variables will differ by age groups and community settings.

(1) Residents' personal characteristics (e.g. gender, race or ethnicity, educational attainment, levels of activities)

(2) Residents' household characteristics (e.g. household income, length of residence, presence of child), and

(3) Locational characteristics (e.g. urban vs. rural, central vs. periphery)

Hypothesis 2. Different physical and social environmental factors will constitute their perceptions of walkability and safety when considering those factors for residential choice across different age groups and community settings.

4.4 METHODS

4.4.1 Study Design and Study Setting

This is a cross-sectional study to explore personal traits and environmental factors related to residential preferences and residential choices. To perform this cross-sectional study, two subsamples were drawn from the Small Town Walkability (STW) project survey conducted in 2011-2012 (Doescher et al., 2014) and the Neighborhood Environment, Physical Activity, and Quality of Life (NPQ) study survey completed in early 2014 (Forjuoh et al., 2017; Ory et al., 2016). Due to the challenges in data acquisition, one small town was excluded and six towns were selected as study towns (Figure 7). Residents from two small towns who were recruited for the STW project were named "the rural subsample", while residents from four towns who were enlisted for the NPQ project were designated "the urban subsample". The age cut-point was set at 65 years, which is most widely accepted and is known to involve significant life changes (Cicirelli, 2002; World Health Organization, 2002). The mean age of all participants was 67.4 years, ranging from 50 to 92 years. Thus, this study divided the sample by age into an "older subsample" (ranging 65 – 92) and a "middle-aged subsample" (ranging 50 – 64). To reduce potential problems which can occur when combining two different datasets, adjustments for the sample frames were conducted. The "total sample" was created by combining the urban subsample and rural subsample. Thus, this dissertation study was performed with the total sample (n=630), and four subsamples: urban (n=294), rural (n=336), older (n=366), and middle-aged (n=264).

Refer to Chapter III for more details about study areas and data collection methods.

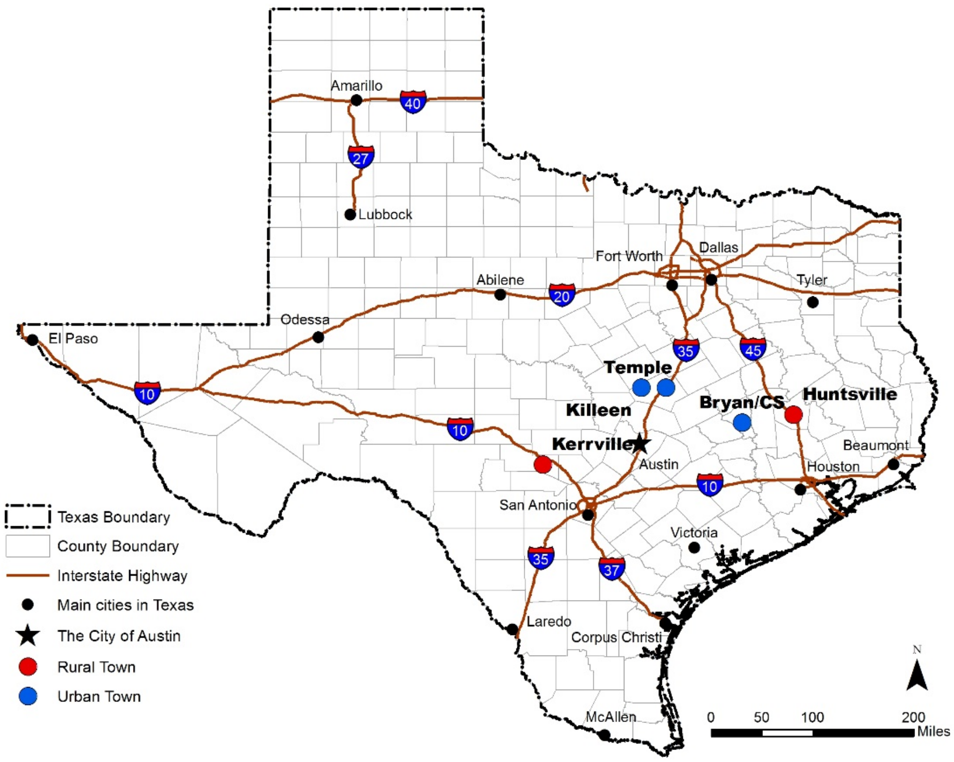

Figure 7 Locations of Study Towns: Four Urban Towns and Two Rural Towns in Texas

4.4.2 Study Variables

Study variables used for analyses encompassed 1) neighborhood consideration variables, 2) personal demographic variables, 3) personal activity variables, 4) household characteristics, 5) perceived safety variables, and 6) objectively measured built environment and incident variables. Personal and household characteristic variables were from the datasets of the STW and the NPQ study surveys. Objectively measured variables were from datasets generated using the Geographical Information System (GIS).

4.4.2.1 Neighborhood Considerations: Outcome Variables and Attitudinal Factors

Neighborhood considerations were measured with four kinds of questions: 1) affordable housing, 2) attractiveness of the neighborhood, 3) ease of walking to retails and services and transit, and 4) neighborhood safety. Respondents were asked to report on a binary scale, the important reasons for choosing their residential locations. Based on the conceptual model, the variables related to neighborhood walkability and safety were used as outcome variables in this study. The outcome variables were estimated separately, thus the variables were used as attitudinal factors together with other consideration variables when an outcome variable was utilized to predict another.

4.4.2.2 Personal, Household, and Locational Characteristics: Independent Variables for Hypothesis 1

Most personal and household characteristics were collected by surveys for the two projects. This study captured personal- and household-level characteristic variables based on the hypotheses encompassing: 1) personal demographics, 2) personal attitudes and activities, 3) household characteristics, and 4) location characteristics of homes. The personal demographics dimension included age, gender, SES (e.g. race/ethnicity, educational attainment, work hours), health conditions (e.g. BMIs, self-evaluated difficulty in walking), and lifestyle-related characteristics (e.g. marital status). The personal attitudes and activities dimension included physical/sedentary activity measures such as walking minutes per week, physical activity levels at work, hours on screen or sitting, and social support for walking. The household characteristics dimension included the length of residence, the number of vehicles, number of children in a household, and the categorized levels of household incomes, which were closely related to lifestyle preference interacting with walking and neighborhood considerations. Locational factors were community settings and proximity to CBDs of homes.

Walking minutes per week were collected by surveys which included all purposes, recreation, and transportation. Because of varying distributions across the types of walking, the walking minutes for any purpose and recreation were categorized into two levels: low minute walkers (0-149 minutes) and high minute walkers (150 minutes or greater). Walking minutes for transportation were categorized into walkers (1 minute at least) and non-walkers (0 minutes). The details were discussed in Chapter III relevant to data collection methods. Household incomes were captured with a 7-point scale: less than $25k (coded as 1), $25k-$34.9k (2), $35k-$49.9k (3), $50k-$74.9k (4), $75k-$99.9k (5), $100k-$149.9k (6), and $150k or more (7). Some personal and household characteristics variables with skewed distributions were manipulated into categorical variables for analyses: BMIs (obesity vs. non-obesity), educational levels (college graduate vs. non-college graduate), difficulties in walking (a little or somewhat difficult vs. no difficulty), physical activity at work (standing/walking/heavy labor vs. no work/sitting), and children in households (the presence of a child vs. none). The proximity to CBDs was captured by the network distances from home locations to CBDs measured by GIS.

4.4.2.3 Environmental Attributes: Independent Variables for Hypothesis 2

Environmental attributes were collected with two kinds of measures: perceptions of environmental attributes and objective environmental attributes. Even though one of two surveys included perceived environmental supports and barriers, social disorder, neighborhood perceptions, and neighborhood attractiveness, another survey was limited in collecting abundant items relevant to perceptions of environmental attributes. For consistency, this study captured perceptions of environmental attributes combining relevant items into three composite safety measures: traffic-related safety (i.e. low traffic, crosswalks and signals, slow speeds), crime-related safety (i.e. well lit, many people, neighbors could be counted on), and walking-related safety (i.e. sidewalks available, adequate sidewalks, fewer dogs). For the composite measures, the dichotomized individual items were summed up by the three kinds of safety attributes. Objective measures identified for this study captured six general categories: 1) infrastructures, 2) greenery, 3) crime and crash incidents, 4) generalized land uses, 5) access to destinations, and 6) residential and employment densities.

The infrastructure dimension included the presence of crosswalks, intersection density, sidewalk completeness, presence of a railroad, or a highway. The greenery was captured by the mean of NDIVs. The crime and crash indents dimension included densities of yearly average numbers of violent crimes, total crimes, pedestrian or cyclist crashes, total crashes, and sex offenders. The generalized land uses dimension included the percentage of single family residences, multifamily residences, commercial uses, agricultural uses, and the presence of industrial and park/recreational uses. The destination dimension included the number of food stores (e.g. supermarkets, retail food stores, convenience stores), food services (e.g. restaurants, fast-food restaurants, pizza places, snack and drinking places), drug and video services, service destinations (e.g. post offices, banks, religious institutions, day care services), community services (e.g. fitness, parks), and educational services (e.g. schools). Objectively measured built environmental and incidents variables were selected based on the hypotheses from datasets created by GIS. The variables which were not directly connected to conceptual models (e.g. pedestrian network completeness) and original measures which were transformed for analyses due to skewness (e.g. number of crosswalks, the length of railroads) were not listed above.

4.4.2.4 Control Variables

This study conceptualized the relationships between the current quality of environmental attributes and residential preferences considered when residents initially chose residential locations. The time gap between the move-in date and the data collection date may result in overlooking the intensity changes in the quality of environmental attributes (Handy et al., 2005; Schwanen & Mokhtarian, 2007). This study created proxy measures to capture the percentage of parcels and areas developed after residents moved in within a 1km buffer from their home locations. The proxy measures were utilized as control variables in analyses to alleviate logical threats to the unmatched time points. The length of residence was also considered as a proxy variable to rule out the drawback. Because of the measures correlated with each other (r=0.642 –

0.695), one of these proxy variables should be chosen as a control variable for the analyses.

4.4.3 Statistical Analysis

Subsample populations (urban vs. rural; older vs. middle-aged) and consideration vs. non-consideration groups (walkability or safety) were first compared on characteristics of residents and environmental factors, using descriptive analyses, independent samples t-tests, and chi-square tests to provide baseline information. Prior to the modeling process, preliminary analyses were undertaken with objectively measured environmental variables by two different spatial units from the residents' home locations: a 1km circular buffer and a 1km sausage network buffer (Appendix A). However, different associations of crime/crash incidents with perceived safety were found between two preliminary analyses with the circular buffers and sausage buffers. For example, a large number of violent crime incidents captured by circular buffers were related to a higher perception of neighborhood safety, compared to crimes measured by sausage buffers where there was diminished perceived safety. Circular buffers created with a non-network basis can be limited in linking to perceptions, even by capturing unperceivable risks (Oliver, Schuurman, & Hall, 2007). This study attempted to employ multilevel approaches due to the nested structure of the data along with the towns and community settings. In the preliminary tests, mixed effect models were estimated with three cluster levels: the residents (level 1) and towns (level 2), and community settings (level 3). However, the effects of multi-levels were not found from the whole modeling process.

Thus, binomial logistic regression models were built to separately estimate the odds of walkability consideration and safety consideration. All modeling processes were repeated across the complete sample and all subsamples: the total sample, and urban, rural, older, and middle-aged subsamples.

The modeling process involved four steps. First, bivariate logistic regression modeling was carried out to understand the bivariate relationships and to obtain information on candidate variables for multivariate modeling. Modeling was processed by adding one variable at a time to a binomial logistic regression model to estimate the odds of neighborhood consideration. All hypothesized measures encompassing personal, household, home location, and environmental characteristics were used for the bivariate modeling. Second, multivariate binomial logistic regression models were estimated with personal, household, and home-locational variables which were significant in the first step, in order to identify characteristics of residents who considered walkability or safety (hypothesis 1). Third, each built environmental and incident variable from the hypotheses was added one at a time to the base models estimated for hypothesis 1 (one-by-one tests). Fourth, all variables which remained significant in the one-by-one test process were added together to the base models, and then the estimations were repeated until these full models included all environmental and incident factors which were significant at a 0.05 level (hypothesis 2). The Stata/IC 14 software package (StataCorp LLC, College Station, TX) was used throughout all the analyses processes. All analyses adopted a significance level of 0.05.

4.5 RESULTS

4.5.1 Personal/Household Characteristics and Environmental Factors by Samples

4.5.1.1 Personal/Household Characteristics by Samples: Descriptive Statistics and Bivariate Analyses

Out of the total sample, 44.0% of respondents were male; the mean age was 67.4; 7.8% were Hispanic and 87.6% were non-Hispanic White; 23.4% were obese (BMI≥30); and 83.0% had education attainment higher than or equal to a college degree. In their households, 7.8% lived with a child; 63.5% earned annual incomes of $50K or more, and the mean number of vehicles was 2.02 (Table 11).

Comparing the urban and rural subsamples, no differences in gender and households with a child were found from bivariate relationships. However, urban residents reported more obesity (27.8% of urban residents vs. 19.5% of rural residents), working hours per week (mean 19.3 vs. 13.8 hours), housing affordability consideration (70.1% vs. 58.6%), and difficulties in walking (18.0% vs. 8.6%) compared to the personal demographics of rural residents. Of household characteristics, urban residents showed a larger number of vehicles (mean 2.13 vs. 1.93) and households earning a high income (≥$50k) (68.4% vs. 59.0%) than rural residents. Rural residents reported older (mean 68.65 among rural residents vs. 65.94 years among urban residents), more Whites (90.8% vs. 84.0%), and college graduates (86.0% vs. 79.5%) than in the personal demographics of urban residents. Of personal attitude and activity variables, they had a higher preference for attractive neighborhoods (90.5% vs. 83.0%) and for neighborhood safety (92.3% vs. 69.0%) than did urban residents. They also showed having someone to walk with more (80.0% vs. 51.0%), physical activities at work (standing, walking, or heavy labor) (26.5% vs. 13.4%), hours on screen (mean 19.18 vs. 13.19 hours per week), walking for transportation at least 1 minute per week (61.3% vs. 16.4%), for recreation during 150 minutes or more (46.1% vs. 27.6%), and living closer to CBDs (mean 4.11 vs. 5.91km) (Table 11).

The older adult and middle-aged subsamples showed differences throughout all of the personal or household characteristics which were important in examining neighborhood considerations and choices (e.g. age, gender, child, income, education). The older adult subsample had more males (48.4% of older adults vs. 37.9% of middle-aged adults), Whites (93.2% vs. 79.9%), difficulties in walking (15.8% vs. 9.1%), length of residence (mean 20.7 vs. 15.9 years), and living in rural towns (59.3% vs. 45.1%) than did the middle-aged subsample. Middle-aged adults reported more Hispanics (13.3% of middle-aged adults vs. 3.8% of older adults), obesity (30.9% vs. 18.0%), employed residents (75.2% vs. 31.5%), and working hours (mean 29.8 vs. 6.5 hours per week) than did older adults. They were also shown to have more physical activities at work (28.2% vs. 14.8%) and housing affordability consideration (70.5% vs. 59.3%) than older adults. For household characteristics, middle-aged adults reported more vehicles (mean 2.30 vs. 1.82), households with a child (13.3% vs. 3.8%), a higher income (≥$50k) (73.2% vs. 56.2%) (Table 11).

Table 11 Characteristics of Sample and Subsamples: Descriptive Statistics and Bivariate Analyses

Domains and variables	N (%) or Mean ± SD				
	Total	Urban	Rural	Older	Middle-aged
Sample size (N)	630	294	336	366	264
Personal – demographics					
Gender: Male (ref= female)	277 (44.0%)	136 (46.3%)	141 (42.0%)	177** (48.4%)	100 (37.9%)
Age: ranging 50 – 92 years	67.39 ±9.638	65.94 ±8.966	68.65*** ±10.032	74.01 ±6.631	58.20 ±3.915
65 years or older (ref= < 65)	366 (58.1%)	149 (50.7%)	217*** (64.6%)	-	-
70 years or older (ref= < 70)	247 (39.2%)	100 (34.0%)	147* (43.8%)	247 (67.5%)	-
Hispanic, Latino or Spanish origin (ref= others)	49 (7.8%)	26 (8.9%)	23 (6.8%)	14 (3.8%)	35*** (13.3%)
Race: non-Hispanic, White (ref= others)	551 (87.6%)	246 (84.0%)	305* (90.8%)	340*** (93.2%)	211 (79.9%)
Obese: BMI>=30 (ref= non-obese (BMI<30))	143 (23.4%)	80* (27.8%)	63 (19.5%)	64 (18.0%)	79*** (30.9%)
Marital status: Married (ref= unmarried)	451 (72.0%)	221 (75.7%)	230 (68.9%)	257 (70.4%)	194 (74.3%)
Education level: some college or higher (ref= lower than some college)	521 (83.0%)	232 (79.5%)	289* (86.0%)	301 (82.5%)	220 (83.7%)
Employment Status: for wages/self-employed (ref= unemployed)	312 (49.8%)	138 (47.4%)	174 (51.8%)	115 (31.5%)	197*** (75.2%)
Working hours per week	16.32 ±20.797	19.27** ±21.028	13.75 ±20.276	6.50 ±14.433	29.78*** ±20.673
Personal – attitudes and activities					
Housing affordability consideration	403 (64.0%)	206** (70.1%)	197 (58.6%)	217 (59.3%)	186** (70.5%)
Attractiveness consideration	548 (87.0%)	244 (83.0%)	304** (90.5%)	313 (85.5%)	235 (89.0%)
Walkability consideration	113 (17.9%)	45 (15.3%)	68 (20.2%)	60 (16.4%)	53 (20.1%)
Safety consideration	513 (81.4%)	203 (69.0%)	310*** (92.3%)	291 (79.5%)	222 (84.1%)
Any difficulty in walking (ref= no difficulty)	82 (13.0%)	53*** (18.0%)	29 (8.6%)	58* (15.8%)	24 (9.1%)
Someone to walk with (ref= no one)	418 (66.5%)	150 (51.0%)	268*** (80.0%)	248 (67.8%)	170 (64.6%)
PA at work: standing/walking/heavy labor (ref= no work/sitting)	128 (20.4%)	39 (13.4%)	89*** (26.5%)	54 (14.8%)	74*** (28.2%)
Screen/sitting hours per week	16.36 ±12.494	13.19 ±8.529	19.18*** ±14.616	16.87 ±11.954	15.67 ±13.192
Walking for all purposes per week: 150+ min. (ref: 0-149 min.)	264 (42.0%)	82 (28.1%)	182*** (54.2%)	158 (43.4%)	106 (40.2%)
Walking for transportation per week: 1+ min. (ref: 0 min.)	254 (40.4%)	48 (16.4%)	206*** (61.3%)	147 (40.3%)	107 (40.7%)
Walking for recreation per week: 150+ min. (ref: 0-149 min.)	236 (37.5%)	81 (27.6%)	155*** (46.1%)	139 (38.0%)	97 (36.7%)

*** Greater than the counterpart (urban vs. rural; older vs. middle-aged) at 0.001; ** at 0.01; and * at 0.05.

Table 11 Continued

Domains and variables	N (%) or Mean ± SD				
	Total	Urban	Rural	Older	Middle-aged
Household characteristics					
Length of residence	18.69 ±12.986	19.30 ±12.155	18.15 ±13.666	20.69*** ±14.306	15.92 ±10.305
The number of vehicles in household	2.02 ±0.945	2.13** ±0.951	1.93 ±0.931	1.82 ±0.841	2.30*** ±1.011
The number of children	0.12 ±0.501	0.12 ±0.470	0.13 ±0.526	0.07 ±0.423	0.20** ±0.584
The presence of children in household	49 (7.8%)	23 (7.8%)	26 (7.7%)	14 (3.8%)	35*** (13.3%)
Annual household income[a]	4.02 ±1.703	4.27** ±1.754	3.79 ±1.624	3.76 ±1.672	4.37*** ±1.686
Annual household income (>=$50k)	376 (63.5%)	195* (68.4%)	181 (59.0%)	190 (56.2%)	186*** (73.2%)
Community setting and home location					
Community setting: Rural town (ref= urban town)	336 (53.3%)	-	-	217*** (59.3%)	119 (45.1%)
Network distance (km) to CBDs	4.95 ±2.749	5.91*** ±2.808	4.11 ±2.405	4.87 ±2.619	5.07 ±2.922

*** Greater than the counterpart (urban vs. rural; older vs. middle-aged) at 0.001; ** at 0.01; and * at 0.05.
[a] Measured with 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" >=$150k.

4.5.1.2 Environmental Factors by Samples: Descriptive Statistics and Bivariate Analyses

In the total sample, respondents reported perceiving neighborhood safety related to traffic (mean 1.90, ranging 0 to 3), crime (mean 2.29, ranging 0 to 3), and walking environments (mean 2.15, ranging 0 to 3). Regarding transportation and pedestrian infrastructures, 54.4% lived in neighborhoods with crosswalks, the mean number of intersections per square kilometer was 6.08, the mean rate of streets covered by sidewalks was 20.6%, 7.3% were passed by railroads, and 21.0% by highways in their neighborhoods. The mean NDVIs was 11.13, the yearly average of violent crimes per km² was 10.0, the yearly average of total crimes was 61.38, the mean number of sex offenders in neighborhoods was 1.56, the yearly average of pedestrian or cyclist crashes was 0.27, and the yearly average of total crashes was 14.63. The mean percentage of single family residential land uses was 44.5%, multifamily residential uses was 3.4%, commercial uses was 6.2%, industrial uses was 0.14%, and park/recreational uses was 1.9%. The mean number of total neighborhood destinations was 12.08 and recreational destinations was 2.76. The mean number of total housing units per km^2 was 523.3, the mean number of parcels with large businesses was 0.72, and the number of employees in the large businesses was 195.4 (Table 12).

No differences between the urban and rural subsamples were found in the perception of neighborhood safety. Urban residents lived with more crosswalks (76.9% of urban residents vs. 34.8% of rural residents), intersections (mean 6.80 vs. 5.44), and railroads (12.2% vs. 3.0%), as well as violent crimes (mean 18.90 vs. 2.21), sex offenders (mean 2.08 vs. 1.10), and total crashes (mean 17.04 vs. 12.53) than did rural residents. The urban resident subsample had a larger percentage of single family residential land uses (mean 47.1% vs. 42.2%), multifamily residential uses (mean 3.8% vs. 3.0%), commercial uses (mean 8.5% vs. 4.1%), and the presence of park/recreational uses (69.7% vs. 62.2%) in their neighborhoods, compared to the rural resident subsample. Urban residents lived in environments with more recreational destinations (mean 3.11 vs. 2.46), food stores (mean 2.05 vs. 1.42), service destinations (mean 5.11 vs. 3.72), community service destinations (mean 1.95 vs. 1.44), and the the presence of educational service destinations (70.4% vs. 47.9%). They also had a higher total housing density (mean 6.60 vs. 4.04) and density of employees (mean 2.79 vs. 1.22). Rural residents lived in neighborhoods with more sidewalks (mean 25.6% for rural residents vs. 14.9% for urban residents), greenery (mean 12.88 vs. 9.13), percent of civic land uses (mean 1.11 % vs. 0.06%), percent of undeveloped lands (mean 20.3% vs. 9.6%), and presence of shopping malls (14.9% vs. 8.5%) (Table 12).

Comparing the older adult and middle-aged adult subsamples, no differences were found in the perceived neighborhood safety. Neighborhoods where older adults lived had a larger percentage of civic land uses (mean 0.77% of older adults vs. 0.41% of middle-aged adults) and undeveloped lands (mean 16.6% vs. 13.5%) than where middle-aged adults lived. The middle-aged adults lived with a larger presence of crosswalks (59.5% of middle-aged adults vs. 50.8% of older adults), a larger presence of railroads (9.8% vs. 5.5%), more violent crimes (mean 11.63 vs. 8.82), more recreational destinations (mean 3.02 vs. 2.58), a larger presence of educational service destinations (63.6% vs. 54.6%), and more total housing units (mean 5.67 vs. 4.92) (Table 12).

Table 12 Self-reported and Objectively Measured Environmental Factors by the Sample and Subsamples: Descriptive Statistics and Bivariate Analyses

Domains and variables	N (%) or Mean ± SD				
	Total	Urban	Rural	Older	Middle -aged
Self-reported perceived safety					
Perceived safety related to traffic	1.90 ±0.857	1.83 ±0.871	1.96 ±0.842	1.89 ±0.852	1.91 ±0.865
Perceived safety related to crime	2.29 ±0.782	2.31 ±0.812	2.26 ±0.755	2.31 ±0.751	2.26 ±0.824
Perceived safety related to walking	2.15 ±0.817	2.19 ±0.790	2.12 ±0.839	2.16 ±0.787	2.15 ±0.857
Overall perceived safety	6.33 ±1.782	6.33 ±1.807	6.34 ±1.763	6.35 ±1.687	6.32 ±1.910
Objective measure – Infrastructures					
Number of crosswalks	4.24 ±6.973	6.53*** ±8.448	2.24 ±4.503	3.63 ±5.927	5.09** ±8.143
Presence of crosswalks	343 (54.4%)	226*** (76.9%)	117 (34.8%)	186 (50.8%)	157* (59.5%)
Intersection density	6.08 ±1.656	6.80*** ±1.453	5.44 ±1.562	6.06 ±1.659	6.10 ±1.655
Pedestrian network completeness	93.37 ±12.378	88.68 ±15.562	97.48*** ±6.295	93.38 ±12.442	93.36 ±12.313
Sidewalk completeness	20.60 ±28.174	14.85 ±21.222	25.64*** ±32.280	20.58 ±28.134	20.64 ±28.282
Presence of railroad	46 (7.3%)	36*** (12.2%)	10 (3.0%)	20 (5.5%)	26* (9.8%)
Presence of highway	132 (21.0%)	68 (23.1%)	64 (19.0%)	77 (21.0%)	55 (20.8%)
Objective measure – Greenery					
Mean of NDVIs: ranging 100 to -100	11.13 ±4.874	9.13 ±3.785	12.88*** ±5.049	11.15 ±4.728	11.11 ±5.078
Objective measure – Crime and crash					
Yearly violent crimes	10.00 ±16.310	18.90*** ±20.101	2.21 ±3.944	8.82 ±15.872	11.63* ±16.792
Yearly property crimes	29.67 ±41.847	49.76*** ±48.972	12.09 ±22.942	26.56 ±41.727	33.98* ±41.710
Yearly behavioral crimes	21.71 ±29.866	35.43*** ±34.616	9.71 ±17.807	19.53 ±29.994	24.73* ±29.477
Yearly total crimes	61.38 ±81.911	104.1*** ±94.006	24.01 ±43.206	54.92 ±81.747	70.34* ±81.446
Number of sex offenders	1.56 ±1.824	2.08*** ±2.187	1.10 ±1.269	1.46 ±1.787	1.69 ±1.871
Yearly pedestrian/cyclist crashes	0.27 ±0.327	0.35*** ±0.368	0.20 ±0.269	0.26 ±0.327	0.29 ±0.327
Yearly vehicle crashes	14.36 ±16.751	16.69** ±19.550	12.33 ±13.553	13.84 ±16.757	15.09 ±16.749
Yearly total crashes	14.63 ±16.982	17.04** ±19.787	12.53 ±13.767	14.10 ±16.987	15.37 ±16.980

*** Greater than the counterpart (urban vs. rural; older vs. middle-aged) at 0.001; ** at 0.01; and * at 0.05.

Table 12 Continued

Domains and variables	N (%) or Mean ± SD				
	Total	Urban	Rural	Older	Middle-aged
Objective measure – Generalized land uses					
% of single family residential uses	44.48 ±13.186	47.13*** ±12.279	42.16 ±13.527	43.96 ±13.042	45.19 ±13.374
% of multifamily residential uses	3.35 ±4.103	3.76* ±3.837	2.99 ±4.296	3.18 ±3.949	3.59 ±4.305
% of commercial uses	6.16 ±6.836	8.48*** ±7.917	4.14 ±4.908	5.77 ±6.773	6.70 ±6.898
% of industrial uses	0.14 ±0.698	0.12 ±0.446	0.15 ±0.860	0.17 ±0.851	0.09 ±0.392
Presence of industrial uses	69 (11.0%)	47*** (16.0%)	22 (6.5%)	41 (11.2%)	28 (10.6%)
% of civic uses	0.62 ±1.556	0.06 ±0.275	1.11*** ±1.992	0.77** ±1.790	0.41 ±1.126
Presence of civic uses	233 (37.0%)	37 (12.6%)	196*** (58.3%)	152** (41.5%)	81 (30.7%)
% of agricultural uses	3.90 ±5.791	5.28*** ±6.790	2.69 ±4.415	3.79 ±5.834	4.05 ±5.738
% of park/recreational uses	1.85 ±2.835	2.03 ±2.509	1.68 ±3.087	1.75 ±2.981	1.99 ±2.619
Presence of park/recreational uses	414 (65.7%)	205* (69.7%)	209 (62.2%)	232 (63.4%)	182 (68.9%)
% of undeveloped lands	15.31 ±11.640	9.61 ±6.786	20.29*** ±12.675	16.61** ±12.395	13.50 ±10.257
Objective measure – Destinations					
Number of total destinations	12.08 ±14.326	12.11 ±12.698	12.05 ±15.631	11.27 ±13.364	13.20 ±15.519
Number of total recreational destinations	2.76 ±2.331	3.11*** ±2.167	2.46 ±2.428	2.58 ±2.265	3.02* ±2.399
Number of food stores	1.71 ±2.356	2.05** ±2.617	1.42 ±2.060	1.68 ±2.312	1.75 ±2.419
Presence of supermarket/warehouse centers	88 (14.0%)	43 (14.6%)	45 (13.4%)	47 (12.8%)	41 (15.5%)
Presence of retail food stores	167 (26.5%)	87 (29.6%)	80 (23.8%)	98 (26.8%)	69 (26.1%)
Presence of convenience stores	314 (49.8%)	160* (54.4%)	154 (45.8%)	176 (48.1%)	138 (52.3%)
Number of food services	3.47 ±6.146	3.21 ±5.353	3.71 ±6.763	3.16 ±5.626	3.92 ±6.787
Presence of restaurants (except fast-food)	291 (46.2%)	147 (50.0%)	144 (42.9%)	163 (44.5%)	128 (48.5%)
Presence of fast-food restaurants	173 (27.5%)	89 (30.3%)	84 (25.0%)	96 (26.2%)	77 (29.2%)
Presence of pizza places	119 (18.9%)	66* (22.4%)	53 (15.8%)	66 (18.0%)	53 (20.1%)
Presence of snack and drinking places	152 (24.1%)	69 (23.5%)	83 (24.7%)	75 (20.5%)	77* (29.2%)
Number of drug stores and video services	0.57 ±1.152	0.54 ±1.095	0.60 ±1.200	0.53 ±1.087	0.63 ±1.236
Presence of shopping malls	75 (11.9%)	25 (8.5%)	50* (14.9%)	40 (10.9%)	35 (13.3%)

*** Greater than the counterpart (urban vs. rural; older vs. middle-aged) at 0.001; ** at 0.01; and * at 0.05.

Table 12 Continued

Domains and variables	N (%) or Mean ± SD				
	Total	Urban	Rural	Older	Middle -aged
Number of service destinations	4.37 ±5.767	5.11** ±6.460	3.72 ±5.004	4.16 ±5.401	4.65 ±6.237
Presence of post offices	41 (6.5%)	14 (4.8%)	27 (8.0%)	21 (5.7%)	20 (7.6%)
Presence of banks	174 (27.6%)	82 (27.9%)	92 (27.4%)	101 (27.6%)	73 (27.7%)
Presence of religious institutions	425 (67.5%)	190 (64.6%)	235 (69.9%)	251 (68.6%)	174 (65.9%)
Presence of child day care services	201 (31.9%)	115*** (39.1%)	86 (25.6%)	102 (27.9%)	99* (37.5%)
Number of community service destinations	1.68 ±1.667	1.95*** ±1.789	1.44 ±1.515	1.56 ±1.601	1.84* ±1.744
Presence of fitness center/recreation facilities	119 (18.9%)	57 (19.4%)	62 (18.5%)	71 (19.4%)	48 (18.2%)
Presence of parks	421 (66.8%)	211* (71.8%)	210 (62.5%)	237 (64.8%)	184 (69.7%)
Number of educational service destinations	1.09 ±1.262	1.16 ±1.123	1.02 ±1.370	1.01 ±1.251	1.19 ±1.273
Presence of educational service destinations	368 (58.4%)	207*** (70.4%)	161 (47.9%)	200 (54.6%)	168* (63.6%)
Objective measure – Density					
Single family housing: 100 units	3.69 ±1.614	4.56*** ±1.644	2.92 ±1.130	3.54 ±1.489	3.89** ±1.754
Multifamily housing: 100 units	1.55 ±1.966	2.04*** ±1.932	1.12 ±1.897	1.38 ±1.846	1.78* ±2.104
Total housing: 100 units	5.23 ±2.779	6.60*** ±2.651	4.04 ±2.302	4.92 ±2.630	5.67** ±2.922
Parcels with large businesses	0.72 ±0.996	0.93*** ±1.188	0.54 ±0.749	0.67 ±1.025	0.79 ±0.953
Employees in large businesses: 100 employees	1.95 ±4.799	2.79*** ±6.362	1.22 ±2.586	1.96 ±4.954	1.95 ±4.584

*** Greater than the counterpart (urban vs. rural; older vs. middle-aged) at 0.001; ** at 0.01; and * at 0.05.

4.5.1.3 Control variables: Parcels developed after move-in

To cover the gaps in time between the residential choice and the data collection, the percentage of parcel counts and the percentage of areas developed after move-in were generated to use control variables. Out of the total sample, 19.4% of parcels and 14.9% of areas were developed within neighborhoods after residents moved in (Table 13). More areas of urban neighborhoods were developed after move-in than those of rural neighborhoods (t=3.402, p=0.001). More parcels (t=4.482, p<0.001) and areas (t=3.835, p<0.001) in neighborhoods of older adults were developed than those of middle-aged adults. The control variables were developed using the years when residents moved in. The length of residence variable was moderately or highly correlated with control variables captured by the percent of numbers of parcels (r=0.642, p<0.001) and the percent of areas of parcels (r=0.695, p<0.001). Thus, the variables capturing the time gaps and the length of residence variable were not controlled together in the multivariate analyses.

Table 13 The percent of Parcels and Areas Developed after the Move-in dates by the Sample and Subsamples: Descriptive Statistics and Bivariate Analyses

Variables	Mean ± SD				
	Total	Urban	Rural	Older	Middle-aged
% of parcels developed after the move-in dates	19.40 ±21.507	20.21 ±22.907	18.68 ±20.210	22.61*** ±23.348	14.94 ±17.760
% of areas developed after the move-in dates	14.90 ±16.038	17.20** ±18.182	12.88 ±13.606	16.96*** ±17.265	12.04 ±13.691

*** Greater than the counterpart (urban vs. rural; older vs. middle-aged) at 0.001; ** at 0.01; and * at 0.05.

4.5.2 Walkability Consideration and Safety Consideration

Out of the total 630 respondents, 113 (17.9%) respondents took into consideration neighborhood walkability when they chose their residences, while 513 (81.4%) considered neighborhood safety. One hundred respondents considered both walkability and safety as important attributes of current residences. One hundred is identical to 15.9% out of the total, 88.5% out of the walkability proponents, and 19.5% out of the safety proponents. Looking at the urban and rural subsamples, 45 (15.3%) urban residents took into consideration neighborhood walkability in their residential choices, while 68 (20.2%) rural residents considered walkability which was not significantly different (χ^2= 2.591, p=0.107). Rural residents (203 (69.0%)) were more likely than urban residents (310 (92.3%)) to place importance on neighborhood safety (χ^2= 55.877, p<0.001). There were 19.9% of rural residents more likely than urban residents (11.2%) to consider both walkability and safety as important attributes of current residences (χ^2= 8.920, p=0.003). In comparing the older adult and middle-aged adult subsamples, 60 (16.4%) older adults and 53 (20.1%) middle-aged adults reported that they took into consideration walkability in residential choices (χ^2= 1.413, p=0.235), and 291 (79.5%) of older adults and 222 (84.1%) of middle-aged adults reported considering safety (χ^2= 2.130, p=0.144). There were 14.2% of older adults and 18.2% of middle-aged adults that placed importance on both walkability and safety (χ^2= 1.814, p=0.178). None of the chi-square tests found differences in neighborhood considerations between older and middle-aged adults (Table 14).

Table 14 Residents Considering Walkability, Safety, and Both Attributes: Descriptive Statistics and Bivariate Analyses by the Sample and Subsamples

Considered attributes	N (%)				
	Total (N=630)	Urban (N=294)	Rural (N=336)	Older (N=366)	Middle-aged (N=264)
Walkability consideration	113 (17.9%)	45 (15.3%)	68 (20.2%)	60 (16.4%)	53 (20.1%)
Safety consideration	513 (81.4%)	203 (69.0%)	310 (92.3%)***	291 (79.5%)	222 (84.1%)
Both considerations	100 (15.9%)	33 (11.2%)	67 (19.9%)**	52 (14.2%)	48 (18.2%)
Out of walkability proponents (N=113)	(88.5%)	(73.3%)	(98.5%)	(86.7%)	(90.6%)
Out of safety proponents (N=513)	(19.5%)	(16.3%)	(21.6%)	(17.9%)	(21.6%)

*** Greater than the counterpart (urban vs. rural; older vs. middle-aged) at 0.001; ** at 0.01; and * at 0.05.

4.5.3 Groups with Consideration vs. Non-Consideration: Bivariate Analyses

4.5.3.1 Personal/Household Characteristics: Walkability Consideration

Out of the total sample, the walkability-consideration group and the non-consideration group showed no difference in the rates of males (43.4% of the consideration group vs. 44.1% of the non-consideration group), obesity (19.3% vs. 24.3%), households with a child (8.0% vs. 7.7%), and the mean age (mean 66.73 vs. 67.53). The consideration group had higher rates of Hispanic residents (16.8% of the consideration group vs. 5.8% of the non-consideration group), safety considerations (88.5% vs. 79.9%), physical activities at work (27.7% vs. 18.9%), walking for transportation (55.8% vs. 37.1%), a longer length of residence (mean 21.53 vs. 18.06 years), and lived closer to CBD (mean 3.72 vs. 5.22 km). The non-consideration group had higher rates of White residents (89.9% of the non-consideration group vs. 77.0% of the consideration group), college graduates (84.7% vs. 75.2%), more vehicles (2.06 vs. 1.85), and a higher income (≥$50k) (65.5% vs. 54.3%) in their households (Table 15).

In both urban and rural resident subsamples, the non-consideration groups had higher rates of White residents (85.9% of urban residents and 93.7% of rural residents) and lived further from CBDs (mean 6.2 km among urban residents and 4.4 km among rural residents) than did the consideration groups. The consideration groups showed more physical activities at work (22.7%) in urban towns, while showing more Hispanic residents (17.6%), housing affordability consideration (69.1%), neighborhood safety consideration (98.5%), utilitarian walking (79.4%), and length of residence (21.9 years) in rural towns. The non-consideration groups reported more residents with a high income

(≥$50k) (71.4%) in urban towns, while there were more adults 65 years or older (67.2%) and college graduates (89.2%) in rural towns (Table 16).

Table 15 Personal and Household Characteristics between Respondents Considering and Not Considering Neighborhood Walkability in the Total Sample: Descriptive Statistics and Bivariate Analyses

Domains and variables	N (%) or Mean ± SD Considered (N=113)	Unconsidered (N=517)	Bivariate tests
Personal - demographics			
Gender: Male (ref: female)	49 (43.4%)	228 (44.1%)	χ^2=0.020 (p=0.886)
Age: ranging 50 – 92 years	66.73±9.848	67.53±9.595	t=-0.781 (p=0.427)
65 years or older (ref= < 65)	60 (53.1%)	306 (59.2%)	χ^2=1.413 (p=0.235)
70 years or older (ref: <70)	41 (36.3%)	206 (39.8%)	χ^2=0.494 (p=0.482)
Hispanic, Latino or Spanish origin (ref= others)	19 (16.8%)	30 (5.8%)	χ^2=15.616 (p<0.001)
Race: non-Hispanic, White (ref= others)	87 (77.0%)	464 (89.9%)	χ^2=14.270 (p<0.001)
Obesity: BMI>=30 (ref: non-obese (BMI<30))	21 (19.3%)	122 (24.3%)	χ^2=1.267 (p=0.260)
Marital status: Married (ref: unmarried)	80 (71.4%)	371 (72.2%)	χ^2=0.026 (p=0.873)
Education level: some college or higher (ref= lower than some college)	85 (75.2%)	436 (84.7%)	χ^2=5.841 (p=0.016)
Employment Status: for wages/self-employed (ref= unemployed)	60 (53.1%)	252 (49.0%)	χ^2=0.614 (p=0.433)
Working hours per week	17.58±20.508	16.05±20.869	t=0.695 (p=0.487)
Personal – attitudes and activities			
Housing affordability consideration	81 (71.7%)	322 (62.3%)	χ^2=3.554 (p=0.059)
Attractiveness consideration	98 (86.7%)	450 (87.0%)	χ^2=0.008 (p=0.928)
Safety consideration	100 (88.5%)	413 (79.9%)	χ^2=4.548 (p=0.033)
Any difficulty in walking (ref= no difficulty)	12 (10.6%)	70 (13.5%)	χ^2=0.698 (p=0.403)
Someone to walk with (ref= no one)	76 (67.3%)	342 (66.3%)	χ^2=0.040 (p=0.842)
PA at work: standing/walking/heavy labor (ref= no work/sitting)	31 (27.7%)	97 (18.9%)	χ^2=4.385 (p=0.036)
Screen/sitting hours per week	15.41±13.384	16.57±12.297	t=-0.834 (p=0.379)
Walking for all purposes per week: 150+ min. (ref: 0-149 min.)	55 (48.7%)	209 (40.6%)	χ^2=2.489 (p=0.115)
Walking for transportation per week: 1+ min. (ref: 0 min.)	63 (55.8%)	191 (37.1%)	χ^2=13.403 (p<0.001)
Walking for recreation per week: 150+ min. (ref: 0-149 min.)	44 (38.9%)	192 (37.1%)	χ^2=0.128 (p=0.720)
Household characteristics			
Length of residence	21.53±14.162	18.06±12.644	t=2.403 (p=0.010)
The number of vehicles in household	1.85±0.868	2.06±0.958	t=-2.269 (p=0.033)
The number of children	0.15±0.586	0.12±0.480	t=0.583 (p=0.509)
The presence of children in household	9 (8.0%)	40 (7.7%)	χ^2=0.007 (p=0.935)
Annual household income[a]	3.70±1.775	4.09±1.682	t=-2.015 (p=0.037)
Annual household income (>=$50k)	57 (54.3%)	319 (65.5%)	χ^2=4.690 (p=0.030)
Community setting and home location			
Community setting: rural town (ref= urban town)	68 (60.2%)	268 (51.8%)	χ^2=2.591 (p=0.107)
Network distance (km) to CBDs	3.72±2.252	5.22±2.777	t=-5.372 (p<0.001)

[a] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" >=$150k.

Table 16 Personal and Household Characteristics between Respondents Considering and Not Considering Neighborhood Walkability in the Urban and Rural Subsamples: Descriptive Statistics and Bivariate Analyses

Domains and variables	N (%) or Mean ± SD			
	Urban towns		Rural towns	
	Considered (N=45)	Unconsidered (N=294)	Considered (N=68)	Unconsidered (N=268)
Personal - demographics				
Gender: Male (ref: female)	21 (46.7%)	115 (46.2%)	28 (41.2%)	113 (42.2%)
Age : ranging 50 – 92 years	65.8±7.97	66.0±9.15	67.3±10.93	69.0±9.78
65 years or older (ref= < 65)	23 (51.1%)	126 (50.6%)	37 (54.4%)	180 (67.2%)*
70 years or older (ref: <70)	13 (28.9%)	87 (34.9%)	28 (41.2%)	119 (44.4%)
Hispanic, Latino or Spanish origin (ref= others)	7 (15.6%)	19 (7.7%)	12 (17.6%)***	11 (4.1%)
Race: non-Hispanic, White (ref= others)	33 (73.3%)	213 (85.9%)*	54 (79.4%)	251 (93.7%)***
Obesity: BMI>=30 (ref: non-obese (BMI<30))	12 (27.3%)	68 (27.9%)	9 (13.8%)	54 (20.9%)
Marital status: Married (ref: unmarried)	32 (71.1%)	189 (76.5%)	48 (71.6%)	182 (68.2%)
Education level: some college or higher (ref= lower than some college)	35 (77.8%)	197 (79.8%)	50 (73.5%)	239 (89.2%)**
Employment Status: for wages/self-employed (ref= unemployed)	22 (48.9%)	116 (47.2%)	38 (55.9%)	136 (50.7%)
Working hours per week	18.7±20.79	19.4±21.11	16.9±20.46	13.0±20.19
Personal – attitudes and activities				
Housing affordability consideration	34 (75.6%)	172 (69.1%)	47 (69.1%)*	150 (56.0%)
Attractiveness consideration	37 (82.2%)	207 (83.1%)	61 (89.7%)	243 (90.7%)
Safety consideration	33 (73.3%)	170 (68.3%)	67 (98.5%)*	243 (90.7%)
Any difficulty in walking (ref= no difficulty)	7 (15.6%)	46 (18.5%)	5 (7.4%)	24 (9.0%)
Someone to walk with (ref= no one)	21 (46.7%)	129 (51.8%)	55 (80.9%)	213 (79.8%)
PA at work: standing/walking/heavy labor (ref= no work/sitting)	10 (22.7%)*	29 (11.8%)	21 (30.9%)	68 (25.4%)
Screen/sitting hours per week	13.0±11.33	13.2 ±7.95	17.1±14.47	19.7±14.63
Walking for all purposes per week: 150+ min. (ref: 0-149 min.)	13 (28.9%)	69 (27.9%)	42 (61.8%)	140 (52.2%)
Walking for transportation per week: 1+ min. (ref: 0 min.)	9 (20.0%)	39 (15.8%)	54 (79.4%)**	152 (56.7%)
Walking for recreation per week: 150+ min. (ref: 0-149 min.)	13 (28.9%)	68 (27.3%)	31 (45.6%)	124 (46.3%)
Household characteristics				
Length of residence	21.0±12.74	19.0±12.05	21.9±15.11*	17.2±13.14
The number of vehicles in household	1.93±0.889	2.16±0.960	1.79±0.856	1.96±0.947
The number of children	0.11±0.487	0.12±0.468	0.18±0.645	0.11±0.492
The presence of children in household	3 (6.7%)	20 (8.0%)	6 (8.8%)	20 (7.5%)
Annual household income[a]	3.80±1.825	4.35±1.731	3.64±1.752	3.83±1.593
Annual household income (>=$50k)	23 (52.3%)	172 (71.4%)*	34 (55.7%)	147 (59.8%)
Home location				
Network distance (km) to CBDs	4.5±2.04	6.2±2.86***	3.2±2.23	4.4±2.39***

[a] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" >=$150k.

*** Greater than the counterpart (considered vs. unconsidered) at 0.001; ** at 0.01; and * at 0.05.

In both older adult and middle-aged subsamples, the consideration groups had higher rates of Hispanic residents (11.7% of older adults and 22.6% of middle-aged adults), utilitarian walkers (56.7% of older adults and 54.7% of middle-aged adults), and those living closer to CBDs (mean 4.0 km among older adults and 3.4 km among middle-aged adults) than the non-consideration groups. The consideration groups showed a longer length of residence (mean 24.8 years) and more households with a child (8.3%) among older adults, while more physical activities at work (39.6%) and rural residents (58.5%) were seen among middle-aged adults. The non-consideration groups consisted of more residents with obesity (20.9%) among older adults, while there were more White residents (83.9%), more college graduates (87.1%), higher incomes (≥$50k) (76.5%), and more vehicles (mean 2.36) in households among middle-aged adults (Table 17).

Table 17 Personal and Household Characteristics between Respondents Considering and Not Considering Neighborhood Walkability in the Older and Middle-aged Subsamples: Descriptive Statistics and Bivariate Analyses

Domains and variables	N (%) or Mean ± SD			
	Older adult		Middle-aged adult	
	Considered (N=60)	Un-considered (N=306)	Considered (N=53)	Un-considered (N=211)
Personal - demographics				
Gender: Male (ref: female)	29 (48.3%)	148 (48.4%)	20 (37.7%)	80 (37.9%)
Age: ranging 50 – 92 years	74.3±6.77	74.0±6.61	58.2±4.16	58.2±3.86
Hispanic, Latino or Spanish origin (ref= others)	7 (11.7%)**	7 (2.3%)	12 (22.6%)*	23 (10.9%)
Race: non-Hispanic, White (ref= others)	53 (88.3%)	287 (94.1%)	34 (64.2%)	177 (83.9%)**
Obesity: BMI>=30 (ref: non-obese (BMI<30))	2 (3.4%)	62 (20.9%)**	19 (38.0%)	60 (29.1%)
Marital status: Married (ref: unmarried)	41 (68.3%)	216 (70.8%)	39 (75.0%)	155 (74.2%)
Education level: some college or higher (ref= lower than some college)	48 (80.0%)	253 (83.0%)	37 (69.8%)	183 (87.1%)**
Employment Status: for wages/self-employed (ref= unemployed)	22 (36.7%)	93 (30.5%)	38 (71.7%)	159 (76.1%)
Working hours per week	8.8 ±17.06	6.1±13.86	27.4±19.74	30.4±20.90
Personal – attitudes and activities				
Housing affordability consideration	40 (66.7%)	177 (57.8%)	41 (77.4%)	145 (68.7%)
Attractiveness consideration	50 (83.3%)	263 (85.9%)	48 (90.6%)	187 (88.6%)
Safety consideration	52 (86.7%)	239 (78.1%)	48 (90.6%)	174 (82.5%)
Any difficulty in walking (ref= no difficulty)	7 (11.7%)	51 (16.7%)	5 (9.4%)	19 (9.0%)
Someone to walk with (ref= no one)	39 (65.0%)	209 (68.3%)	37 (69.8%)	133 (63.3%)
PA at work: standing/walking/heavy labor (ref= no work/sitting)	10 (16.9%)	44 (14.4%)	21 (39.6%)*	53 (25.4%)
Screen/sitting hours per week	15.0±10.76	17.2±12.16	15.9±15.95	15.6±12.46
Walking for all purposes per week: 150+ min. (ref: 0-149 min.)	29 (48.3%)	129 (42.4%)	26 (49.1%)	80 (37.9%)
Walking for transportation per week: 1+ min. (ref: 0 min.)	34 (56.7%)**	113 (37.0%)	29 (54.7%)*	78 (37.1%)
Walking for recreation per week: 150+ min. (ref: 0-149 min.)	23 (38.3%)	116 (37.9%)	21 (39.6%)	76 (36.0%)
Household characteristics				
Length of residence	24.8±14.69*	19.9±14.11	17.8±12.68	15.4±9.60
The number of vehicles in household	1.68±0.813	1.85±0.845	2.04±0.898	2.36±1.030*
The number of children	0.18±0.701*	0.05±0.340	0.11±0.423	0.22±0.617
The presence of children in household	5 (8.3%)*	9 (2.9%)	4 (7.5%)	31 (14.7%)
Annual household income[a]	3.49±1.845	3.81±1.635	3.94±1.683	4.47±1.674*
Annual household income (>=$50k)	27 (49.1%)	163 (57.6%)	30 (60.0%)	156 (76.5%)*
Community setting and home location				
Community setting: Rural town (ref= urban town)	37 (61.7%)	180 (58.8%)	31 (58.5%)*	88 (41.7%)
Network distance (km) to CBDs	4.0±2.25	5.0±2.66**	3.4±2.23	5.5±2.93***

[a] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" >=$150k.

*** Greater than the counterpart (considered vs. unconsidered) at 0.001; ** at 0.01; and * at 0.05.

4.5.3.2 Personal/Household Characteristics: Safety Consideration

In the total sample, the safety consideration group and the non-consideration group showed no differences in the key personal and household factors such as the rates of male residents (42.5% of the consideration group vs. 50.4% of the non-consideration group), educated residents (84.0% vs. 78.4%), households with a child (8.0% vs. 6.8%), and the mean age of residents (mean 67.25 vs. 67.98). The consideration group had higher rates of attractiveness consideration (93.2% of the consideration group vs. 59.8% of the non-consideration group), for utilitarian walkability (19.5% vs. 11.1%), someone to walk with (68.8% vs. 56.4%), utilitarian walkers (45.3% vs. 19.0%), recreational walkers (40.2% vs. 25.6%), and rural residents (60.4% vs. 22.2%). The non-consideration group showed higher rates of Hispanic residents (14.7% of the non-consideration group vs. 6.2% of the consideration group), difficulty in walking (22.2% vs. 10.9%), and a longer length of residence (mean 23.38 vs. 17.61 years) (Table 18).

In both urban resident and rural resident subsamples, the consideration groups had higher rates of attractiveness consideration (92.1% of urban residents and 93.9% or rural residents), while the non-consideration groups had a longer length of residence (mean 22.0 years among urban residents and 28.2 years among rural residents). The consideration groups showed higher rates of married residents (79.7%) and higher household incomes (mean 4.43) in the urban resident subsample, while the rates were higher housing affordability consideration (61.0%), utilitarian walkability (21.6%), walking for transportation (63.2%), and walking for recreations (48.1%) in the rural resident subsample. The non-consideration groups had more Hispanic residents (17.8%)

and lived closer to CBDs (mean 5.3 km) in the urban resident subsample, while there were more residents 65 years or older (84.6%), walking difficulty (19.2%), and hours on screen (mean 27.1 hours per week) in the rural resident subsample (Table 19).

Table 18 Personal and Household Characteristics between Respondents Considering and Not Considering Neighborhood Safety in the Total Sample: Descriptive Statistics and Bivariate Analyses

Domains and variables	N (%) or Mean ± SD Considered (N=513)	Unconsidered (N=117)	Bivariate tests
Personal - demographics			
Gender: Male (ref: female)	218 (42.5%)	59 (50.4%)	χ^2=2.433 (p=0.119)
Age: ranging 50 – 92 years	67.25±9.696	67.98±9.396	t=-0.740 (p=0.459)
65 years or older (ref= < 65)	291 (56.7%)	75 (64.1%)	χ^2=2.130 (p=0.144)
70 years or older (ref: <70)	198 (38.6%)	49 (41.9%)	χ^2=0.431 (p=0.511)
Hispanic, Latino or Spanish origin (ref= others)	32 (6.2%)	17 (14.7%)	χ^2=9.332 (p=0.002)
Race: non-Hispanic, White (ref= others)	455 (88.7%)	96 (82.8%)	χ^2=3.068 (p=0.080)
Obesity: BMI>=30 (ref: non-obese (BMI<30))	112 (22.4%)	31 (27.7%)	χ^2=1.398 (p=0.237)
Marital status: Married (ref: unmarried)	374 (73.3%)	77 (66.4%)	χ^2=2.269 (p=0.132)
Education level: some college or higher (ref= lower than some college)	430 (84.0%)	91 (78.4%)	χ^2=2.051 (p=0.152)
Employment Status: for wages/self-employed (ref= unemployed)	260 (50.8%)	52 (45.2%)	χ^2=1.163 (p=0.281)
Working hours per week	16.24±20.884	16.67±20.489	t=-0.193 (p=0.847)
Personal – attitudes and activities			
Housing affordability consideration	337 (65.7%)	66 (56.4%)	χ^2=3.561 (p=0.059)
Attractiveness consideration	478 (93.2%)	70 (59.8%)	χ^2=93.583 (p<0.001)
Walkability consideration	100 (19.5%)	13 (11.1%)	χ^2=4.548 (p=0.033)
Any difficulty in walking (ref= no difficulty)	56 (10.9%)	26 (22.2%)	χ^2=10.756 (p=0.001)
Someone to walk with (ref= no one)	352 (68.8%)	66 (56.4%)	χ^2=6.505 (p=0.011)
PA at work: standing/walking/heavy labor (ref= no work/sitting)	105 (20.5%)	23 (20.0%)	χ^2=0.017 (p=0.895)
Screen/sitting hours per week	16.54±12.300	15.56±13.347	t=0.765 (p=0.445)
Walking for all purposes per week: 150+ min. (ref: 0-149 min.)	231 (45.2%)	33 (28.2%)	χ^2=11.292 (p=0.001)
Walking for transportation per week: 1+ min. (ref: 0 min.)	232 (45.3%)	22 (19.0%)	χ^2=27.255 (p<0.001)
Walking for recreation per week: 150+ min. (ref: 0-149 min.)	206 (40.2%)	30 (25.6%)	χ^2=8.568 (p=0.003)
Household characteristics			
Length of residence	17.61±12.368	23.38±14.552	t=-4.401 (p<0.001)
The number of vehicles in household	2.03±0.955	2.00±0.904	t=0.261 (p=0.794)
The number of children	0.13±0.522	0.09±0.394	t=0.675 (p=0.500)
The presence of children in household	41 (8.0%)	8 (6.8%)	χ^2=0.177 (p=0.674)
Annual household income[a]	4.06±1.706	3.83±1.688	t=1.310 (p=0.191)
Annual household income (>=$50k)	311 (64.4%)	65 (59.6%)	χ^2=0.868 (p=0.351)
Community setting and home location			
Community setting: Rural town (ref= urban town)	310 (60.4%)	26 (22.2%)	χ^2=55.877 (p<0.001)
Network distance (km) to CBDs	4.95±2.743	4.94±2.788	t=0.051 (p=0.960)

[a] Measured with a 7-point scale: “1” <$25k, “2” $25k-$34.9k, “3” $35k-$49.9k, “4” $50k-$74.9k, “5” $75k-$99.9k, “6” $100k-$149.9k, and “7” >=$150k.

Table 19 Personal and Household Characteristics between Respondents Considering and Not Considering Neighborhood Safety in the Urban and Rural Subsamples: Descriptive Statistics and Bivariate analyses

Domains and variables	N (%) or Mean ± SD			
	Urban		Rural	
	Considered (N=203)	Un-considered (N=91)	Considered (N=310)	Un-considered (N=26)
Personal - demographics				
Gender: Male (ref: female)	92 (45.3%)	44 (48.4%)	126 (40.6%)	15 (57.7%)
Age: ranging 50 – 92 years	65.4±8.81	67.1±9.26	68.4±10.07	71.2±9.33
65 years or older (ref= < 65)	96 (47.3%)	53 (58.2%)	195 (62.9%)	22 (84.6%)*
70 years or older (ref: <70)	64 (31.5%)	36 (39.6%)	134 (43.2%)	13 (50.0%)
Hispanic, Latino or Spanish origin (ref= others)	10 (4.9%)	16 (17.8%)***	22 (7.1%)	1 (3.8%)
Race: non-Hispanic, White (ref= others)	174 (85.7%)	72 (80.0%)	281 (90.6%)	24 (92.3%)
Obesity: BMI>=30 (ref: non-obese (BMI<30))	53 (26.4%)	27 (31.0%)	59 (19.8%)	4 (16.0%)
Marital status: Married (ref: unmarried)	161 (79.7%)*	60 (66.7%)	213 (69.2%)	17 (65.4%)
Education level: some college or higher (ref= lower than some college)	163 (80.7%)	69 (76.7%)	267 (86.1%)	22 (84.6%)
Employment Status: for wages/self-employed (ref= unemployed)	99 (49.0%)	39 (43.8%)	161 (51.9%)	13 (50.0%)
Working hours per week	19.7±21.04	18.4±21.10	14.0±20.51	10.8±17.35
Personal – attitudes and activities				
Housing affordability consideration	148 (72.9%)	58 (63.7%)	189 (61.0%)**	8 (30.8%)
Attractiveness consideration	187 (92.1%)***	57 (62.6%)	291 (93.9%)***	13 (50.0%)
Walkability consideration	33 (16.3%)	12 (13.2%)	67 (21.6%)*	1 (3.8%)
Any difficulty in walking (ref= no difficulty)	32 (15.8%)	21 (23.1%)	24 (7.7%)	5 (19.2%)*
Someone to walk with (ref= no one)	105 (51.7%)	45 (49.5%)	247 (79.9%)	21 (80.8%)
PA at work: standing/walking/heavy labor (ref= no work/sitting)	22 (10.9%)	17 (19.1%)	83 (26.8%)	6 (23.1%)
Screen/sitting hours per week	13.5±8.65	12.5±8.27	18.6±13.86	27.1±20.98**
Walking for all purposes per week: 150+ min. (ref: 0-149 min.)	58 (28.9%)	24 (26.4%)	173 (55.8%)*	9 (34.6%)
Walking for transportation per week: 1+ min. (ref: 0 min.)	36 (17.8%)	12 (13.3%)	196 (63.2%)*	10 (38.5%)
Walking for recreation per week: 150+ min. ref: 0-149 min.)	57 (28.1%)	24 (26.4%)	149 (48.1%)*	6 (23.1%)
Household characteristics				
Length of residence	18.1±11.59	22.0±12.99*	17.3±12.86	28.2±18.58***
The number of vehicles in household	2.17±0.955	2.03±0.942	1.93±0.944	1.88±0.766
The number of children	0.12±0.487	0.11±0.433	0.13±0.544	0.04±0.196
The presence of children in household	16 (7.9%)	7 (7.7%)	25 (8.1%)	1 (3.8%)
Annual household income[a]	4.43±1.755*	3.89±1.701	3.80±1.624	3.59±1.652
Annual household income (>=$50k)	142 (71.7%)	53 (60.9%)	169 (59.3%)	12 (54.5%)
Home location				
Network distance (km) to CBDs	6.17±2.728*	5.34±2.913	4.16±2.451	3.55±1.708

[a] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" >=$150k.

*** Greater than the counterpart (considered vs. unconsidered) at 0.001; ** at 0.01; and * at 0.05.

In both older adult and middle-aged subsamples, the consideration groups showed higher rates of attractiveness consideration (93.1% of older adults and 93.2% of middle-aged adults), walking for transportation (45.4% of older adults and 45.2% of middle-aged adults), and rural residents (67.0% of older adults and 51.8% of middle-aged adults) than did the non-consideration groups. The consideration groups had higher rates of residents having someone to walk with (70.8%) and walking for recreation (40.9%) among older adults. The non-consideration groups reported more difficulties in walking (28.0%) and a longer length of residence (mean 26.0 years) among older adults, while there were more Hispanic residents (31.0%) and working hours (mean 35.9 hours per week) among middle-aged adults (Table 20).

Table 20 Personal and Household Characteristics between Respondents Considering and Not Considering Neighborhood Safety in the Older and Middle-aged Subsamples: Descriptive Statistics and Bivariate Analyses

Domains and variables	N (%) or Mean ± SD			
	Older adult		Middle-aged adult	
	Considered (N=291)	Un-considered (N=75)	Considered (N=222)	Un-considered (N=42)
Personal - demographics				
Gender: Male (ref: female)	136 (46.7%)	41 (54.7%)	82 (36.9%)	18 (42.9%)
Age: ranging 50 – 92 years	74.1±6.71	73.7±6.35	58.3±4.02	57.8±3.30
Hispanic, Latino or Spanish origin (ref= others)	10 (3.4%)	4 (5.4%)	22 (9.9%)	13 (31.0%)***
Race: non-Hispanic, White (ref= others)	273 (93.8%)	67 (90.5%)	182 (82.0%)	29 (69.0%)
Obesity: BMI>=30 (ref: non-obese (BMI<30))	46 (16.3%)	18 (25.0%)	66 (30.6%)	13 (32.5%)
Marital status: Married (ref: unmarried)	208 (71.5%)	49 (66.2%)	166 (75.8%)	28 (66.7%)
Education level: some college or higher (ref= lower than some college)	242 (83.2%)	59 (79.7%)	188 (85.1%)	32 (76.2%)
Employment Status: for wages/self-employed (ref= unemployed)	97 (33.3%)	18 (24.3%)	163 (73.8%)	34 (82.9%)
Working hours per week	6.67±14.951	5.85±12.248	28.65±20.978	35.88±17.977*
Personal – attitudes and activities				
Housing affordability consideration	178 (61.2%)	39 (52.0%)	159 (71.6%)	27 (64.3%)
Attractiveness consideration	271 (93.1%)***	42 (56.0%)	207 (93.2%)***	28 (66.7%)
Walkability consideration	52 (17.9%)	8 (10.7%)	48 (21.6%)	5 (11.9%)
Any difficulty in walking (ref= no difficulty)	37 (12.7%)	21 (28.0%)**	19 (8.6%)	5 (11.9%)
Someone to walk with (ref= no one)	206 (70.8%)*	42 (56.0%)	146 (66.1%)	24 (57.1%)
PA at work: standing/walking/heavy labor (ref= no work/sitting)	45 (15.5%)	9 (12.3%)	60 (27.3%)	14 (33.3%)
Screen/sitting hours per week	17.3±11.42	15.2±13.81	15.6±13.32	16.3±12.64
Walking for all purposes per week: 150+ min. (ref: 0-149 min.)	134 (46.4%)*	24 (32.0%)	97 (43.7%)**	9 (21.4%)
Walking for transportation per week: 1+ min. (ref: 0 min.)	132 (45.4%)***	15 (20.3%)	100 (45.2%)**	7 (16.7%)
Walking for recreation per week: 150+ min. (ref: 0-149 min.)	119 (40.9%)*	20 (26.7%)	87 (39.2%)	10 (23.8%)
Household characteristics				
Length of residence	19.3±13.51	26.0±16.04***	15.4±10.31	18.7±9.98
The number of vehicles in household	1.79±0.831	1.95±0.874	2.33±1.019	2.10±0.958
The number of children	0.08±0.456	0.04±0.257	0.20±0.591	0.19±0.552
The presence of children in household	12 (4.1%)	2 (2.7%)	29 (13.1%)	6 (14.3%)
Annual household income[a]	3.79±1.660	3.64±1.723	4.41±1.703	4.15±1.594
Annual household income (>=$50k)	151 (56.1%)	39 (56.5%)	160 (74.8%)	26 (65.0%)
Community setting and home location				
Community setting: Rural town (ref= urban town)	195 (67.0%)***	22 (29.3%)	115 (51.8%)***	4 (9.5%)
Network distance (km) to CBDs	4.82±2.571	5.05±2.808	5.13±2.951	4.74±2.775

[a] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" >=$150k.

*** Greater than the counterpart (considered vs. unconsidered) at 0.001; ** at 0.01; and * at 0.05.

4.5.3.3 Environmental Factors: Walkability Consideration

Out of the total sample, the walkability consideration group had more crosswalks (72.6% of the consideration group vs. 50.5% of the non-consideration group), intersections (mean 6.38 vs. 6.01), sidewalks (mean 29.4% vs. 18.7%), and highways (30.1% vs. 19.0%) related to infrastructures. The non-consideration group had higher rates of greenery (mean 11.34 in the non-consideration group vs. 10.19 in the consideration group). The consideration group had a higher perceived safety from traffic (mean 2.08 vs. 1.86), density of violent crimes (mean 13.19 vs. 9.30 yearly per square kilometer), total crimes (mean 86.73 vs. 55.84), sex offenders (mean 1.99 vs. 1.46), pedestrian/cyclist crashes (mean 0.40 vs. 0.24), and total crashes (mean 22.91 vs. 12.82) in terms of safety risks in neighborhoods. The non-consideration group perceived higher safety related to walking (mean 2.18 vs. 2.01). Regarding land uses and neighborhood destinations, the consideration group had a larger percentage of multifamily residential land uses (mean 4.1% vs. 3.2%), commercial uses (mean 8.7% vs. 5.6%), more food stores (mean 3.02 vs. 1.43), food services (mean 6.91 vs. 2.72), drug or video stores (mean 1.10 vs. 0.45), presence of shopping malls (26.5% vs. 8.7%), service destinations (mean 7.34 vs. 3.72), community service destinations (mean 2.05 vs. 1.60), and presence of educational service destinations (74.3% vs. 54.9%). The non-consideration group had more single family residential land uses (mean 45.1% vs. 41.5%), agricultural uses (mean 4.2% vs. 2.4%), and undeveloped lands (mean 15.8% vs. 13.3%). Related to density, the consideration group had more multifamily units (mean 1.92 vs. 1.46), parcels with large businesses (mean 1.03 vs. 0.65), and employees in the large businesses (mean 2.96 vs. 1.73) per square kilometer in their neighborhoods (Table 21).

Table 21 Environmental Factors between Respondents Considering and Not Considering Neighborhood Walkability in the Total Sample: Descriptive Statistics and Bivariate analyses

Domains and variables	N (%) or Mean ± SD		Bivariate
	Considered (N=113)	Unconsidered (N=517)	
Self-reported perceived safety			
Perceived safety related to traffic	2.08±0.918	1.86±0.839	t=2.513 (p=0.012)
Perceived safety related to crime	2.29±0.776	2.28±0.784	t=0.095 (p=0.925)
Perceived safety related to walking	2.01±0.861	2.18±0.804	t=-2.068 (p=0.039)
Overall perceived safety	6.38±1.91	6.32±1.755	t=0.300 (p=0.764)
Objective measure - Infrastructures			
Number of crosswalks	6.43±9.225	3.76±6.287	t=3.724 (p<0.001)
Presence of crosswalks	82 (72.6%)	261 (50.5%)	χ^2=18.232 (p<0.001)
Intersection density	6.38±1.555	6.01±1.672	t=2.122 (p=0.034)
Sidewalk completeness	29.35±31.997	18.69±26.924	t=3.682 (p<0.001)
Presence of railroad	13 (11.5%)	33 (6.4%)	χ^2=3.594 (p=0.058)
Presence of highway	34 (30.1%)	98 (19.0%)	χ^2=6.940 (p=0.008)
Objective measure - Greenery			
Mean of NDVIs: ranging 100 to -100	10.19±5.267	11.34±4.764	t=-2.270 (p=0.024)
Objective measure - Crime and crash			
Yearly violent crimes	13.19±18.125	9.30±15.819	t=2.305 (p=0.021)
Yearly property crimes	43.84±53.629	26.57±38.169	t=4.020 (p<0.001)
Yearly behavioral crimes	29.7±34.216	19.97±28.568	t=3.162 (p=0.002)
Yearly total crimes	86.73±97.797	55.84±77.015	t=3.667 (p<0.001)
Number of sex offenders	1.99±1.986	1.46±1.775	t=2.823 (p=0.005)
Yearly pedestrian/cyclist crashes	0.40±0.347	0.24±0.316	t=4.773 (p<0.001)
Yearly vehicle crashes	22.52±18.805	12.58±15.734	t=5.860 (p<0.001)
Yearly total crashes	22.91±19.055	12.82±15.951	t=5.872 (p<0.001)
Objective measure - Generalized land uses			
% of single family residential uses	41.53±13.057	45.12±13.138	t=-2.633 (p=0.009)
% of multifamily residential uses	4.11±4.258	3.19±4.054	t=2.167 (p=0.031)
% of commercial uses	8.67±7.172	5.61±6.642	t=4.371 (p<0.001)
% of industrial uses	0.15±0.667	0.13±0.705	t=0.197 (p=0.844)
Presence of industrial uses	16 (14.2%)	53 (10.3%)	χ^2=1.452 (p=0.228)
% of civic uses	0.58±1.049	0.63±1.647	t=-0.299 (p=0.765)
Presence of civic uses	50 (44.2%)	183 (35.4%)	χ^2=3.117 (p=0.077)
% of agricultural uses	2.44±4.516	4.22±5.991	t=-2.963 (p=0.003)
% of park/recreational uses	1.94±2.497	1.83±2.906	t=0.383 (p=0.702)
Presence of park/recreational uses	83 (73.5%)	331 (64%)	χ^2=3.659 (p=0.056)
% of undeveloped lands	13.29±9.25	15.75±12.062	t=-2.037 (p=0.042)
Objective measure - Destinations			
Number of food stores	3.02±3.027	1.43±2.079	t=6.725 (p<0.001)
Number of food services	6.91±7.942	2.72±5.403	t=6.794 (p<0.001)
Number of drug stores and video services	1.10±1.470	0.45±1.036	t=5.498 (p<0.001)
Presence of shopping malls	30 (26.5%)	45 (8.7%)	χ^2=28.156 (p<0.001)
Number of service destinations	7.34±6.804	3.72±5.304	t=6.221 (p<0.001)
Number of community service destinations	2.05±1.802	1.60±1.626	t=2.655 (p=0.008)
Presence of educational service destinations	84 (74.3%)	284 (54.9%)	χ^2=14.373 (p<0.001)
Objective measure - Density			
Single family housing: 100 units	3.68±1.553	3.69±1.628	t=-0.069 (p=0.945)
Multifamily housing: 100 units	1.92±2.093	1.46±1.93	t=2.257 (p=0.024)
Total housing: 100 units	5.60±2.612	5.15±2.810	t=1.554 (p=0.121)
Parcels with large businesses	1.03±1.124	0.65±0.954	t=3.663 (p<0.001)
Employees in large businesses: 100 persons	2.96±5.515	1.73±4.604	t=2.472 (p=0.014)

In the urban and rural resident subsamples, the consideration groups had a larger presence of crosswalks, more crimes: violent, property, behavioral, and total crimes; crashes: pedestrian/cyclist and vehicle crashes; commercial land uses; destinations: food stores, food services, drug/video stores, shopping malls, neighborhood services, and educational services; and large businesses. In urban neighborhoods, the consideration group had a larger presence of highways and civic uses than did the non-consideration group. In rural neighborhoods, the consideration group had higher perceived safety from traffic, more intersections, sidewalks, railroads, sex offenders, multifamily residential uses, industrial uses, park/recreational uses, community service destinations, the density of multifamily units, and employees. The non-consideration groups had more single family land uses and undeveloped lands (Table 22).

In both older and middle-aged adult subsamples, the consideration groups had more crosswalks, sidewalks, behavioral crimes, pedestrian/cyclist crashes, total crashes, commercial land uses, food stores, food services, shopping malls, drug/video stores, service destinations, and educational service destinations. Among older adults, the consideration group had higher perceived safety from traffic, more property crimes, total crimes, large businesses, and employees. Among middle-aged adults, the consideration group had more intersections, railroads, highways, sex offenders, multifamily land uses, industrial uses, civic uses, and community service destinations, while the non-consideration group had higher perceived safety for walking and more agricultural land uses (Table 23).

Table 22 Environmental Factors between Respondents Considering and Not Considering Neighborhood Walkability in the Urban and Rural Subsamples: Descriptive Statistics and Bivariate Analyses

Domains and variables	N (%) or Mean ± SD			
	Urban		Rural	
	Considered (N=45)	Unconsidered (N=249)	Considered (N=68)	Unconsidered (N=268)
Self-reported perceived safety				
Perceived safety related to traffic	1.93±0.889	1.81±0.868	2.18±0.929*	1.90±0.811
Perceived safety related to crime	2.16±0.852	2.34±0.803	2.38±0.713	2.23±0.764
Perceived safety related to walking	2.09±0.821	2.20±0.784	1.96±0.888	2.16±0.823
Overall perceived safety	6.18±1.946	6.35±1.784	6.51±1.889	6.30±1.731
Objective measure - Infrastructures				
Number of crosswalks	9.38±12.03*	6.02±7.542	4.49±6.124***	1.67±3.798
Presence of crosswalks	42 (93.3%)**	184 (73.9%)	40 (58.8%)***	77 (28.7%)
Intersection density	7.12±1.312	6.75±1.472	5.89±1.517**	5.33±1.556
Sidewalk completeness	14.2±16.84	15.0±21.95	39.4±35.62***	22.2±30.47
Presence of railroad	8 (17.8%)	28 (11.2%)	5 (7.4%)*	5 (1.9%)
Presence of highway	18 (40.0%)**	50 (20.1%)	16 (23.5%)	48 (17.9%)
Objective measure – Greenery				
Mean of NDVIs: ranging 100 to -100	7.6±2.84	9.4±3.87**	11.9±5.78	13.1±4.83
Objective measure - Crime and crash				
Yearly violent crimes	27.7±20.85**	17.3±19.59	3.62±5.485**	1.85±3.366
Yearly property crimes	81.4±57.70***	44.0±45.03	19.0±32.33**	10.4±19.57
Yearly behavioral crimes	50.5±36.46**	32.7±33.64	16.0±24.54**	8.13±15.31
Yearly total crimes	159.6±99.5***	94.0±89.58	38.5±59.73**	20.3±37.14
Number of sex offenders	2.36±2.182	2.03±2.189	1.75±1.822***	0.93±1.025
Yearly pedestrian/cyclist crashes	0.50±0.380**	0.32±0.360	0.34±0.310***	0.17±0.246
Yearly vehicle crashes	25.8±21.22**	15.0±18.81	20.3±16.83***	10.3±11.79
Yearly total crashes	26.3±21.44**	15.4±19.04	20.7±17.10***	10.5±11.97
Objective measure - Generalized land uses				
% of single family residential uses	45.2±11.21	47.5±12.46	39.1±13.67	42.9±13.40*
% of multifamily residential uses	4.18±2.986	3.69±3.972	4.05±4.945*	2.72±4.081
% of commercial uses	11.67±8.11**	7.90±7.758	6.69±5.719***	3.49±4.466
% of industrial uses	0.14±0.531	0.12±0.430	0.15±0.747	0.15±0.887
Presence of industrial use	6 (13.3%)	41 (16.5%)	10 (14.7%)**	12 (4.5%)
% of civic uses	0.05±0.108	0.07±0.295	0.93±1.232	1.15±2.143
Presence of civic use	10 (22.2%)*	27 (10.8%)	40 (58.8%)	156 (58.2%)
% of agricultural uses	2.62±4.058	5.76±7.07**	2.33±4.821	2.78±4.311
% of park/recreational uses	2.05±2.277	2.03±2.553	1.87±2.647	1.64±3.192
Presence of park/recreational use	32 (71.1%)	173 (69.5%)	51 (75.0%)*	158 (59.0%)
% of undeveloped lands	8.4±4.46	9.8±7.11	16.5±10.18	21.3±13.08**
Objective measure- Destinations				
Number of food stores	3.51±3.217***	1.79±2.408	2.69±2.872***	1.09±1.654
Number of food services	6.04±6.684***	2.69±4.919	7.49±8.676***	2.75±5.827
Number of drug stores and video services	1.02±1.373**	0.45±1.015	1.15±1.538***	0.46±1.057
Presence of shopping malls	11 (24.4%)***	14 (5.6%)	19 (27.9%)**	31 (11.6%)
Number of service destinations	8.71±7.698***	4.45±6.001	6.43±6.031***	3.03±4.467
Number of community service destinations	2.20±1.984	1.90±1.753	1.96±1.679**	1.31±1.445
Presence of educational service destinations	40 (88.9%)**	167 (67.1%)	44 (64.7%)**	117 (43.7%)
Objective measure – Density				
Single family housing: 100 units	4.80±1.417	4.52±1.680	2.93±1.143	2.92±1.128
Multifamily housing: 100 units	2.48±1.828	1.96±1.943	1.56±2.188*	1.00±1.804
Total housing: 100 units	7.28±2.030	6.47±2.733	4.49±2.356	3.93±2.278
Parcels with large businesses	1.27±1.436*	0.86±1.130	0.87±0.832***	0.46±0.704
Employees in large businesses: 100 persons	4.14±7.733	2.55±6.068	2.18±3.165**	0.98±2.362

*** Greater than the counterpart (considered vs. unconsidered) at 0.001; ** at 0.01; and * at 0.05.

Table 23 Environmental Factors between Respondents Considering and Not Considering Neighborhood Walkability in the Older and Middle-aged Subsamples: Descriptive Statistics and Bivariate Analyses

Domains and variables	N (%) or Mean ± SD			
	Older adult		Middle-aged adult	
	Considered (N=60)	Unconsidered (N=306)	Considered (N=53)	Unconsidered (N=211)
Self-reported perceived safety				
Perceived safety related to traffic	2.15±0.840**	1.83±0.846	2.00±1.000	1.89±0.829
Perceived safety related to crime	2.33±0.705	2.30±0.760	2.25±0.853	2.26±0.818
Perceived safety related to walking	2.12±0.846	2.16±0.776	1.89±0.870	2.21±0.843*
Overall perceived safety	6.60±1.689	6.30±1.685	6.13±2.122	6.36±1.855
Objective measure - Infrastructures				
Number of crosswalks	5.73±7.708**	3.22±5.432	7.23±10.71*	4.55±7.295
Presence of crosswalks	41 (68.3%)**	145 (47.4%)	41 (77.4%)**	116 (55.0%)
Intersection density	6.23±1.617	6.03±1.668	6.54±1.479*	5.99±1.681
Sidewalk completeness	27.9±30.21*	19.2±27.54	31.1±34.12**	18.0±26.06
Presence of railroad	3 (5.0%)	17 (5.6%)	10 (18.9%)*	16 (7.6%)
Presence of highway	16 (26.7%)	61 (19.9%)	18 (34.0%)**	37 (17.5%)
Objective measure - Greenery				
Mean of NDVIs: ranging 100 to -100	10.32±5.523	11.31±4.548	10.04±5.010	11.37±5.072
Objective measure - Crime and crash				
Yearly violent crimes	12.43±18.226	8.11±15.302	14.06±18.145	11.02±16.424
Yearly property crimes	44.9±61.27***	23.0±35.76	42.7±43.97	31.8±40.94
Yearly behavioral crimes	27.7±37.77*	17.9±28.02	32.0±29.88*	22.9±29.16
Yearly total crimes	85.0±108.61**	49.0±74.18	88.7±84.91	65.7±80.10
Number of sex offenders	1.82±1.852	1.39±1.768	2.19±2.130*	1.57±1.784
Yearly pedestrian/cyclist crashes	0.38±0.360**	0.23±0.315	0.43±0.333**	0.26±0.317
Yearly vehicle crashes	21.1±17.51***	12.4±16.26	24.2±20.21***	12.8±14.97
Yearly total crashes	21.4±17.79***	12.7±16.48	24.6±20.44***	13.1±15.19
Objective measure - Generalized land uses				
% of single family residential uses	41.09±12.368	44.53±13.116	42.03±13.898	46.00±13.154
% of multifamily residential uses	3.65±4.340	3.09±3.869	4.62±4.143*	3.32±4.315
% of commercial uses	8.76±7.398***	5.19±6.497	8.57±6.976*	6.23±6.814
% of industrial uses	0.12±0.706	0.18±0.877	0.18±0.625*	0.06±0.306
Presence of industrial use	8 (13.3%)	33 (10.8%)	8 (15.1%)	20 (9.5%)
% of civic uses	0.61±1.059	0.80±1.901	0.55±1.048	0.38±1.145
Presence of civic use	23 (38.3%)	129 (42.2%)	27 (50.9%)***	54 (25.6%)
% of agricultural uses	2.97±5.491	3.95±5.894	1.85±3.006	4.60±6.121**
% of park/recreational uses	1.72±1.966	1.75±3.144	2.19±2.988	1.94±2.524
Presence of park/recreational use	44 (73.3%)	188 (61.4%)	39 (73.6%)	143 (67.8%)
% of undeveloped lands	14.6±11.03	17.0±12.62	11.9±6.50	13.9±10.97
Objective measure - Destinations				
Number of food stores	3.00±2.846***	1.42±2.103	3.04±3.246***	1.43±2.049
Number of food services	6.13±7.210***	2.57±5.074	7.79±8.683***	2.94±5.854
Number of drug stores and video services	1.03±1.402***	0.43±0.987	1.17±1.553***	0.49±1.106
Presence of shopping malls	15 (25.0%)***	25 (8.2%)	15 (28.3%)***	20 (9.5%)
Number of service destinations	6.95±6.382***	3.62±5.021	7.77±7.290***	3.86±5.699
Number of community service destinations	1.78±1.530	1.52±1.614	2.36±2.039*	1.71±1.641
Presence of educational service destinations	40 (66.7%)*	160 (52.3%)	44 (83.0%)**	124 (58.8%)
Objective measure - Density				
Single family housing: 100 units	3.63±1.526	3.52±1.484	3.73±1.596	3.93±1.793
Multifamily housing: 100 units	1.66±2.089	1.32±1.793	2.22±2.078	1.67±2.101
Total housing: 100 units	5.29±2.530	4.84±2.647	5.95±2.682	5.60±2.981
Parcels with large businesses	1.09±1.222**	0.59±0.964	0.96±1.009	0.74±0.936
Employees in large businesses: 100 persons	3.33±6.929*	1.69±4.432	2.54±3.269	1.80±4.853

*** Greater than the counterpart (considered vs. unconsidered) at 0.001; ** at 0.01; and * at 0.05.

4.5.3.4 Environmental Factors: Safety Consideration

In the total sample, the safety consideration group had higher perceived safety from traffic (mean 1.93 in the consideration group vs. 1.74 in the non-consideration group), rates of greenery (mean 11.47 vs. 9.63), percent of civic land uses (mean 0.70% vs. 0.29%), and percent of undeveloped lands (mean 16.1% vs. 11.9%). The non-consideration groups had more crosswalks (71.8% of the non-consideration group vs. 50.5% of the consideration group), intersections (mean 6.66 vs. 5.95), and railroads (16.2% vs. 5.3%) related to infrastructures. The non-consideration group was involved in more violent crimes (mean 17.64 vs. 8.26), total crimes (mean 105.0 vs. 51.4), pedestrian/cyclists crashes (mean 0.38 vs. 0.25), total crashes (mean 19.87 vs. 13.44), and had a higher number of sex offenders (mean 2.34 vs. 1.38) in terms of safety risks in neighborhoods. Regarding land uses and neighborhood destinations, the non-consideration group had a larger presence of industrial land uses (17.9% vs. 9.4%), parks/recreational uses (76.9% vs. 63.2%), percent of commercial uses (mean 8.8% vs. 5.6%), food stores (mean 2.70 vs. 1.49), food services (mean 4.71 vs. 3.19), drug or video stores (mean 0.78 vs. 0.52), service destinations (mean 5.99 vs. 4.00), community service destinations (mean 2.10 vs. 1.58), and presence of educational service destinations (68.4% vs. 56.1%). Related to density, the consideration group had more single family units (mean 3.99 in the consideration group vs. 3.62 in the non-consideration group), total housing units (mean 5.77 vs. 5.11), large businesses (mean 1.03 vs. 0.65), and employees (mean 3.21 vs. 1.67) (Table 24).

Table 24 Environmental Factors between Respondents Considering and Not Considering Neighborhood Safety in the Total Sample: Descriptive Statistics and Bivariate Analyses

Domains and variables	N (%) or Mean ± SD Considered (N=513)	N (%) or Mean ± SD Unconsidered (N=117)	Bivariate
Perceived safety			
Perceived safety related to traffic	1.93±0.851	1.74±0.873	t=2.149 (p=0.032)
Perceived safety related to crime	2.31±0.765	2.19±0.850	t=1.499 (p=0.134)
Perceived safety related to walking	2.15±0.805	2.15±0.867	t=-0.021 (p=0.983)
Overall perceived safety	6.39±1.748	6.09±1.914	t=1.680 (p=0.093)
Objective measure - Infrastructures			
Number of crosswalks	3.63±5.904	6.92±10.046	t=-4.683 (p<0.001)
Presence of crosswalks	259 (50.5%)	84 (71.8%)	χ^2=17.44 (p<0.001)
Intersection density	5.95±1.569	6.66±1.897	t=-4.255 (p<0.001)
Sidewalk completeness	20.93±28.943	19.18±24.580	t=0.604 (p=0.546)
Presence of railroad	27 (5.3%)	19 (16.2%)	χ^2=16.958 (p<0.001)
Presence of highway	101 (19.7%)	31 (26.5%)	χ^2=2.666 (p=0.103)
Objective measure - Greenery			
Mean of NDVIs: ranging 100 to -100	11.47±4.795	9.63±4.956	t=3.722 (p<0.001)
Objective measure - Crime and crash			
Yearly violent crimes	8.26±14.592	17.64±20.74	t=-5.759 (p<0.001)
Yearly property crimes	25.34±38.355	48.64±50.563	t=-5.562 (p<0.001)
Yearly behavioral crimes	17.84±23.785	38.70±44.519	t=-7.082 (p<0.001)
Yearly total crimes	51.4±71.33	105.0±107.57	t=-6.594 (p<0.001)
Number of sex offenders	1.38±1.649	2.34±2.300	t=-5.262 (p<0.001)
Yearly pedestrian/cyclist crashes	0.25±0.302	0.38±0.405	t=-3.916 (p<0.001)
Yearly vehicle crashes	13.19±15.18	19.50±21.722	t=-3.712 (p<0.001)
Yearly total crashes	13.44±15.408	19.87±21.951	t=-3.739 (p<0.001)
Objective measure - Generalized land uses			
% of single family residential uses	44.62±12.938	43.85±14.262	t=0.574 (p=0.566)
% of multifamily residential uses	3.28±4.146	3.65±3.914	t=-0.859 (p=0.391)
% of commercial uses	5.56±6.156	8.78±8.808	t=-4.676 (p<0.001)
% of industrial uses	0.12±0.709	0.20±0.644	t=-1.019 (p=0.308)
Presence of industrial uses	48 (9.4%)	21 (17.9%)	χ^2=7.211 (p=0.007)
% of civic uses	0.70±1.65	0.29±0.991	t=2.567 (p=0.010)
Presence of civic uses	203 (39.6%)	30 (25.6%)	χ^2=7.932 (p=0.005)
% of agricultural uses	3.75±5.499	4.55±6.917	t=-1.359 (p=0.175)
% of park/recreational uses	1.78±2.962	2.17±2.181	t=-1.346 (p=0.179)
Presence of park/recreational uses	324 (63.2%)	90 (76.9%)	χ^2=8.012 (p=0.005)
% of undeveloped lands	16.08±12.007	11.93±9.175	t=3.508 (p<0.001)
Objective measure - Destinations			
Number of food stores	1.49±2.088	2.70±3.105	t=-5.128 (p<0.001)
Number of food services	3.19±5.789	4.71±7.416	t=-2.418 (p=0.016)
Number of drug stores and video services	0.52±1.107	0.78±1.314	t=-2.170 (p=0.030)
Presence of shopping malls	58 (11.3%)	17 (14.5%)	χ^2=0.944 (p=0.331)
Number of service destinations	4.00±5.141	5.99±7.770	t=-3.406 (p=0.001)
Number of community service destinations	1.58±1.646	2.10±1.699	t=-3.075 (p=0.002)
Presence of educational service destinations	288 (56.1%)	80 (68.4%)	χ^2=5.872 (p=0.015)
Objective measure - Density			
Single family housing: 100 units	3.62±1.581	3.99±1.725	t=-2.249 (p=0.025)
Multifamily housing: 100 units	1.49±1.961	1.78±1.983	t=-1.431 (p=0.153)
Total housing: 100 units	5.11±2.77	5.77±2.767	t=-2.322 (p=0.021)
Parcels with large businesses	0.65±0.883	1.03±1.351	t=-3.701 (p<0.001)
Employees in large businesses: 100 persons	1.67±3.929	3.21±7.400	t=-3.163 (p=0.002)

The non-consideration groups lived with more sex offenders in neighborhoods in both urban and rural towns. In urban neighborhoods, the consideration group had higher perceived safety from traffic, more single family residences, and single family housing units. The non-consideration group had more infrastructures: crosswalks and railroads; crimes: property and behavioral crimes and sex offenders; crashes: pedestrian/cyclist and vehicle crashes; lands for: industrial use and commercial use; destinations: food stores, food services, drug/video stores, and service destinations; and density of large businesses and employees. In rural neighborhoods, the non-consideration group lived in neighborhoods with more sex offenders (Table 25).

In both older adult and middle-aged adult subsamples, the consideration groups had more undeveloped lands. The non-consideration groups had a larger presence of crosswalks, intersections, railroads, more violent and total crimes, sex offenders, pedestrian/cyclist, total crashes, commercial land uses, food stores, service destinations, large businesses, and employees. Among the older adult subsample, the consideration group had more civic land uses, while the non-consideration group had more highways, park/recreational land uses, food services, drug or video stores, community service destinations, and multifamily units. Among the middle-aged adult subsample, the consideration group had higher perceived safety from crime and more greenery, while the non-consideration group had more industrial land uses (Table 26).

Table 25 Environmental Factors between Respondents Considering and Not Considering Neighborhood Safety in the Urban and Rural Subsamples: Descriptive Statistics and Bivariate Analyses

Domains and variables	N (%) or Mean ± SD			
	Urban		Rural	
	Considered (N=203)	Unconsidered (N=91)	Considered (N=310)	Unconsidered (N=26)
Self-reported perceived safety				
Perceived safety related to traffic	1.90±0.853*	1.67±0.895	1.95±0.850	2.00±0.748
Perceived safety related to crime	2.37±0.769	2.18±0.889	2.26±0.760	2.23±0.710
Perceived safety related to walking	2.17±0.765	2.23±0.844	2.14±0.832	1.88±0.909
Overall perceived safety	6.44±1.743	6.08±1.928	6.36±1.753	6.12±1.904
Objective measure - Infrastructures				
Number of crosswalks	5.73±7.048	8.32±10.777*	2.26±4.529	2.04±4.266
Presence of crosswalks	150 (73.9%)	76 (83.5%)	109 (35.2%)	8 (30.8%)
Intersection density	6.72±1.265	6.98±1.798	5.44±1.540	5.53±1.834
Sidewalk completeness	14.0±20.63	16.8±22.50	25.5±32.52	27.5±29.83
Presence of railroad	18 (8.9%)	18 (19.8%)**	9 (2.9%)	1 (3.8%)
Presence of highway	42 (20.7%)	26 (28.6%)	59 (19.0%)	5 (19.2%)
Objective measure - Greenery				
Mean of NDVIs: ranging 100 to -100	9.25±3.197	8.87±4.858	12.93±5.103	12.31±4.406
Objective measure - Crime and crash				
Yearly violent crimes	17.6±19.29	21.9±21.64	2.2±3.92	2.9±4.24
Yearly property crimes	45.7±47.10	58.8±52.05*	12.0±23.15	13.2±20.70
Yearly behavioral crimes	30.6±26.11	46.3±46.89***	9.5±17.77	12.2±18.40
Yearly total crimes	93.9±83.87	126.9±110.5**	23.7±43.30	28.2±42.62
Number of sex offenders	1.87±2.043	2.55±2.427*	1.05±1.228	1.61±1.625*
Yearly pedestrian/cyclist crashes	0.32±0.334	0.43±0.428*	0.20±0.270	0.21±0.255
Yearly vehicle crashes	14.7±17.23	21.2±23.41**	12.2±13.62	13.4±12.93
Yearly total crashes	15.0±17.47	21.7±23.64**	12.4±13.84	13.6±13.11
Objective measure - Generalized land uses				
% of single family residential uses	48.6±10.96**	43.8±14.32	42.0±13.47	44.0±14.34
% of multifamily residential uses	3.77±3.820	3.75±3.897	2.96±4.323	3.29±4.032
% of commercial uses	7.86±7.152	9.85±9.301*	4.06±4.859	5.07±5.482
% of industrial uses	0.08±0.244	0.23±0.706**	0.15±0.890	0.08±0.336
Presence of industrial use	28 (13.8%)	19 (20.9%)	20 (6.5%)	2 (7.7%)
% of civic uses	0.06±0.277	0.07±0.272	1.11±2.006	1.07±1.865
Presence of civic use	26 (12.8%)	11 (12.1%)	177 (57.1%)	19 (73.1%)
% of agricultural uses	5.27±6.419	5.30±7.591	2.75±4.543	1.94±2.333
% of park/recreational uses	1.88±2.590	2.38±2.293	1.71±3.183	1.41±1.541
Presence of park/recreational use	135 (66.5%)	70 (76.9%)	189 (61.0%)	20 (76.9%)
% of undeveloped lands	9.40±6.478	10.06±7.444	20.5±12.77	18.5±11.58
Objective measure - Destinations				
Number of food stores	1.63±2.152	3.00±3.252***	1.40±2.043	1.65±2.279
Number of food services	2.42±3.594	4.97±7.729***	3.70±6.814	3.81±6.248
Number of drug stores and video services	0.42 ±0.974	0.79±1.295**	0.59±1.184	0.73±1.402
Presence of shopping malls	13 (6.4%)	12 (13.2%)	45 (14.5%)	5 (19.2%)
Number of service destinations	4.37±5.216	6.74±8.421**	3.75±5.085	3.38±3.971
Number of community service destinations	1.83±1.781	2.22±1.788	1.42±1.532	1.69±1.289
Presence of educational service destinations	143 (70.4%)	64 (70.3%)	145 (46.8%)	16 (61.5%)
Objective measure - Density				
Single family housing: 100 units	4.69±1.581*	4.26±1.747	2.92±1.120	3.03±1.259
Multifamily housing: 100 units	2.06±1.867	1.98±2.079	1.12±1.934	1.08±1.424
Total housing: 100 units	6.75±2.588	6.24±2.768	4.03±2.324	4.11±2.061
Parcels with large businesses	0.81±1.031	1.18±1.454*	0.55±0.755	0.48±0.684
Employees in large businesses: 100 persons	2.28±5.263	3.95±8.224*	1.27±2.660	0.64±1.320

*** Greater than the counterpart (considered vs. unconsidered) at 0.001; ** at 0.01; and * at 0.05.

Table 26 Environmental Factors between Respondents Considering and Not Considering Neighborhood Safety in the Older and Middle-aged Subsamples: Descriptive Statistics and Bivariate Analyses

Domains and variables	N (%) or Mean ± SD			
	Older adult		Middle-aged adult	
	Considered (N=291)	Unconsidered (N=75)	Considered (N=222)	Unconsidered (N=42)
Self-reported perceived safety				
Perceived safety related to traffic	1.92±0.835	1.73±0.905	1.94±0.873	1.76±0.821
Perceived safety related to crime	2.30±0.755	2.32±0.738	2.32±0.778**	1.95±0.987
Perceived safety related to walking	2.17±0.763	2.11±0.879	2.13±0.859	2.24±0.850
Overall perceived safety	6.40±1.623	6.16±1.917	6.39±1.903	5.95±1.925
Objective measure - Infrastructures				
Number of crosswalks	3.22±5.681	5.21±6.601**	4.17±6.157	10.0±13.86***
Presence of crosswalks	137 (47.1%)	49 (65.3%)**	122 (55.0%)	35 (83.3%)**
Intersection density	5.95±1.583	6.51±1.873**	5.94±1.553	6.90±1.94***
Sidewalk completeness	21.0±29.15	19.0±23.88	20.9±28.73	19.5±26.08
Presence of railroad	11 (3.8%)	9 (12.0%)**	16 (7.2%)	10 (23.8%)**
Presence of highway	55 (18.9%)	22 (29.3%)*	46 (20.7%)	9 (21.4%)
Objective measure – Greenery				
Mean of NDVIs: ranging 100 to -100	11.39±4.638	10.22±4.984	11.6±5.00***	8.59±4.788
Objective measure - Crime and crash				
Yearly violent crimes	7.04±14.074	15.8±20.13***	9.86±15.128	21.0±21.63***
Yearly property crimes	22.0±38.31	44.2±49.41***	29.7±38.07	56.6±52.20***
Yearly behavioral crimes	15.0±22.83	37.0±44.79***	21.5±24.55	41.8±44.41***
Yearly total crimes	44.1±70.52	96.9±106.0***	61.1±71.39	119±110.2***
Number of sex offenders	1.31±1.634	2.06±2.195**	1.47±1.666	2.85±2.422***
Yearly pedestrian/cyclist crashes	0.23±0.309	0.35±0.381**	0.27±0.293	0.43±0.446**
Yearly vehicle crashes	12.7±15.74	18.4±19.68**	13.9±14.42	21.5±25.09**
Yearly total crashes	12.9±15.98	18.8±19.87**	14.1±14.63	21.9±25.38**
Objective measure - Generalized land uses				
% of single family residential uses	43.9±12.83	44.3±13.94	45.6±13.05	43.0±14.96
% of multifamily residential uses	3.00±3.866	3.89±4.208	3.66±4.468	3.22±3.330
% of commercial uses	5.15±6.093	8.18±8.568**	6.10±6.210	9.87±9.225**
% of industrial uses	0.18±0.913	0.14±0.553	0.05±0.248	0.29±0.779***
Presence of industrial use	31 (10.7%)	10 (13.3%)	17 (7.7%)	11 (26.2%)***
% of civic uses	0.88±1.901*	0.35±1.190	0.46±1.208	0.18±0.450
Presence of civic use	132 (45.4%)**	20 (26.7%)	71 (32.0%)	10 (23.8%)
% of agricultural uses	3.59±5.444	4.55±7.143	3.95±5.576	4.55±6.580
% of park/recreational uses	1.71±3.189	1.88±1.988	1.86±2.639	2.68±2.428
Presence of park/recreational use	173 (59.5%)	59 (78.7%)**	151 (68.0%)	31 (73.8%)
% of undeveloped lands	17.6±12.66**	12.9±10.58	14.1±10.81*	10.2±5.63
Objective measure - Destinations				
Number of food stores	1.49±2.144	2.43±2.766**	1.48±2.017	3.19±3.617***
Number of food services	2.86±5.466	4.32±6.110*	3.64±6.172	5.40±9.352
Number of drug stores and video services	0.47±1.004	0.76±1.344*	0.59±1.228	0.81±1.273
Presence of shopping malls	28 (9.6%)	12 (16.0%)	30 (13.5%)	5 (11.9%)
Number of service destinations	3.84±5.024	5.41±6.558*	4.20±5.296	7.02±9.565**
Number of community service destinations	1.45±1.598	1.99±1.555*	1.75±1.696	2.31±1.932
Presence of educational service destinations	152 (52.2%)	48 (64.0%)	136 (61.3%)	32 (76.2%)
Objective measure - Density				
Single family housing: 100 units	3.47±1.441	3.82±1.645	3.82±1.732	4.29±1.840
Multifamily housing: 100 units	1.28±1.775	1.77±2.062*	1.78±2.151	1.79±1.858
Total housing: 100 units	4.74±2.556	5.59±2.816*	5.59±2.965	6.09±2.680
Parcels with large businesses	0.60±0.890	0.96±1.405**	0.72±0.871	1.14±1.258**
Employees in large businesses: 100 persons	1.69±4.573	3.00±6.144*	1.64±2.886	3.59±9.305*

*** Greater than the counterpart (considered vs. unconsidered) at 0.001; ** at 0.01; and * at 0.05.

4.5.4 Correlates of Neighborhood Considerations: Multivariate Analyses

4.5.4.1 Personal, Household, and Community Predictors

Out of the total sample, residents who walked for utilitarian purposes at least 1 minute per week (OR 1.587, p=0.046), considered neighborhood safety (OR 2.179, p=0.022), had a longer length of residence (OR 1.020, p=0.018), and lived closer to CBDs (OR 0.820, p<0.001) were more likely to prioritize neighborhood walkability in their residential choices. White (OR 0.374, p=0.001) were less likely to consider neighborhood walkability (Table 27). Residents who walked for utilitarian purposes (OR 2.058, p=0.021), considered neighborhood attractiveness (OR 8.467, p<0.001), housing affordability (OR 1.672, p=0.041), resided in rural towns (OR 4.732, p<0.001), and had lived at their current residence for a short duration (OR 0.971, p=0.001) were more likely to focus on neighborhood safety (Table 28).

Comparing urban and rural resident subsamples, residents who lived closer to CBDs (OR 0.785, p=0.001) were more likely to consider neighborhood walkability than remote residents in urban towns. Residents who considered neighborhood safety (OR 11.352, p=0.027), walked for utilitarian purposes at least 1 minute per week (OR 2.529, p=0.010), had a longer length of residence (OR 1.025, p=0.033), and lived closer to CBDs (OR 0.793, p=0.003) were more likely to favor neighborhood walkability in rural towns. White (OR 0.364, p=0.033), obese (OR 0.361, p=0.027), and educated (OR 0.344, p=0.010) were less likely to take into consideration neighborhood walkability in rural towns (Table 27). Residents who considered neighborhood attractiveness were more likely to regard neighborhood safety (OR 6.024, p<0.001), while Hispanics residents (OR 0.371, p=0.034) and those who lived longer at their current residential locations (OR 0.975, p=0.027) were less likely to consider neighborhood safety in urban towns. In rural towns, residents who walked for utilitarian purposes (OR 3.109, p=0.025) and considered neighborhood attractiveness (OR 20.110, p<0.001) were more likely to prioritize neighborhood safety, while residents who spent more time watching screens or sitting (OR 0.962, p=0.004) were less likely to place importance on neighborhood safety (Table 28).

When considering the older adult and middle-aged subsamples, utilitarian walking (OR 1.885, p=0.042) and length of residence (OR 1.025, p=0.017) were positive correlates, but obesity (OR 0.150, p=0.010) and a distance to CBDs (OR 0.867, p=0.040) were negative correlates of neighborhood walkability considerations among older adults. Residents who considered neighborhood safety (OR 3.037, p=0.043) were more likely to consider walkability, while White residents (OR 0.309, p=0.002), having a child in the household (OR 0.305, p=0.047), and living in longer distance from CBDs (OR 0.709, p<0.001) were negative correlates of neighborhood walkability focus among middle-aged adults (Table 27). Among older residents, those who considered neighborhood attractiveness (OR 9.516, p<0.001), had a shorter length of residence (OR 0.973, p=0.009), and resided in rural towns (OR 4.633, p<0.001) were more likely to prioritize neighborhood safety. Among middle-aged residents, those who considered neighborhood attractiveness (OR 5.674, p=0.001) and non-Hispanic origins (OR 0.300, p=0.014), and resided in rural towns (OR 11.478, p<0.001) were more likely to think about neighborhood safety (Table 28).

Table 27 Personal and Household Predictors of the Odds of Neighborhood Walkability Consideration: Multivariate Analyses by the Sample and Subsamples

Domains and variables	OR (p-value)				
	Total	Urban	Rural	Older	Middle-aged
Personal - demographics					
Race: non-Hispanic, White (ref= others)	0.374 (p=0.001)	0.468 (p=0.055)	0.364 (p=0.033)		0.309 (p=0.002)
Obesity: BMI>=30 (ref= non-obese (BMI<30))			0.361 (p=0.027)	0.150 (p=0.010)	
Education level: some college or higher (ref= lower than some college)			0.344 (p=0.010)		
Personal – attitudes and activities					
Safety consideration	2.179 (p=0.022)		11.352 (p=0.027)		3.037 (p=0.043)
Walking for transportation per week: 1+ min. (ref: 0 min.)	1.586 (p=0.046)		2.529 (p=0.010)	1.885 (p=0.042)	
Household characteristics and home locations					
Length of residence	1.020 (p=0.018)		1.025 (p=0.033)	1.025 (p=0.017)	
Presence of children in household					0.305 (p=0.047)
Network distance (km) to CBDs	0.820 (p<0.001)	0.785 (p=0.001)	0.793 (p=0.003)	0.867 (p=0.040)	0.709 (p<0.001)
Akaike information criterion (AIC)	546.875	239.883	286.192	296.764	232.500
Bayesian information criterion (BIC)	573.511	250.923	316.413	316.097	250.379
Pseudo R^2	0.095	0.069	0.167	0.100	0.160

Table 28 Personal and Household Predictors of the Odds of Neighborhood Safety Consideration: Multivariate Analyses by the Sample and Subsamples

Domains and variables	OR (p-value)				
	Total	Urban	Rural	Older	Middle-aged
Personal – demographics					
Hispanic, Latino or Spanish origin (ref= others)		0.371 (p=0.034)			0.300 (p=0.014)
Personal - attitudes and activities					
Housing affordability consideration	1.672 (p=0.041)				
Attractiveness consideration	8.467 (p<0.001)	6.024 (p<0.001)	20.110 (p<0.001)	9.516 (p<0.001)	5.674 (p=0.001)
Screen/sitting hours per week			0.962 (p=0.004)		
Walking for transportation per week: 1+ min. (ref: 0 min.)	2.058 (p=0.021)		3.109 (p=0.025)		
Household characteristics and community settings					
Length of residence	0.971 (p=0.001)	0.975 (p=0.027)	0.972 (p=0.078)	0.973 (p=0.009)	
Community setting: Rural (ref= urban)	4.732 (p<0.001)			4.633 (p<0.001)	11.478 (p<0.001)
Akaike information criterion (AIC)	467.354	322.854	134.639	290.502	185.892
Bayesian information criterion (BIC)	493.999	337.561	153.650	306.102	200.195
Pseudo R^2	0.242	0.127	0.276	0.238	0.231

4.5.4.2 Environmental Correlates

In the total sample, residents who perceived higher safety from traffic (OR 1.415, p=0.014) and lived with food stores (OR 1.263, p<0.001) and shopping malls (OR 2.415, p=0.004) in neighborhoods were more likely to consider neighborhood walkability when selecting their residence. Looking at the urban and rural resident subsamples, urban residents considered neighborhood walkability if they lived in environments with more food stores (OR 1.269, p<0.001), shopping malls (OR 4.033, p=0.004), schools (OR 3.116, p=0.030), and less industrial areas (OR 0.300, p=0.037). Rural residents who perceived higher safety from traffic (OR 2.247, p<0.001), lived in environments with more food services (OR 1.070, p=0.010), and perceived lower safety for walking (OR 0.533, p=0.003) tended to value neighborhood walkability. Older adults who perceived higher safety from traffic (OR 2.028, p=0.001) and lived with more shopping malls (OR 2.735, p=0.023), food stores (OR 1.343, p<0.001), fewer single family housings (OR 0.967, p=0.013), and industrial uses (OR 0.317, p=0.036) were more likely to select for neighborhood walkability. Middle-aged adults who resided in environments with a lower perceived safety for walking (OR 0.603, p=0.012) and more civic use areas (OR 2.679, p=0.005) and food services (OR 1.099, p<0.001) were more likely to consider neighborhood walkability (Table 29).

Table 29 Environmental Correlates of the Odds of Neighborhood Walkability Considerations: Multivariate Analyses Controlling for Covariates by the Sample and Subsamples

Domains and variables	OR (p-value)				
	Total	Urban	Rural	Older	Middle-aged
Self-reported perceived safety					
Perceived safety related to traffic	1.415 (p=0.014)		2.247 (p<0.001)	2.028 (p=0.001)	
Perceived safety related to walking			0.533 (p=0.003)		0.603 (p=0.012)
Objective measure - Generalized land uses					
% of single family residential uses				0.967 (p=0.013)	
% of multifamily residential uses					
Presence of industrial uses		0.300 (p=0.037)		0.317 (p=0.036)	
Presence of civic uses					2.679 (p=0.005)
Objective measure - Destinations					
Number of food stores	1.263 (p<0.001)	1.269 (p<0.001)	1.191 (p=0.051)	1.343 (p<0.001)	
Number of food services			1.070 (p=0.010)		1.099 (p<0.001)
Presence of shopping mall	2.415 (p=0.004)	4.033 (p=0.004)		2.735 (p=0.023)	
Presence of educational service destination		3.116 (p=0.030)			
Akaike information criterion (AIC)	517.858	225.435	265.333	271.678	227.510
Bayesian information criterion (BIC)	553.372	247.516	303.109	302.632	252.541
Pseudo R^2	0.151	0.157	0.243	0.199	0.194

Residents who lived in environments with more recreational areas (OR 0.505, p=0.017) and food stores (OR 0.883, p=0.010) were less likely to focus on neighborhood safety. Among urban residents, considerations of neighborhood safety were positively associated with a higher perception of traffic-related safety (OR 1.560, p=0.015). It was negatively correlated with a higher perception of walking-related safety (OR 0.513, p=0.002), more green spaces (OR 0.884, p=0.008), parks/recreational areas (OR 0.460, p=0.027), and food services (OR 0.886, p=0.001). A larger number of service destinations (OR 1.204, p=0.047) was a positive correlate, while a higher rate of single family residences (OR 0.939, p=0.010) was a negative correlate of safety considerations in neighborhoods. Among older-aged residents, considerations of neighborhood safety were negatively associated with the presence of parks/recreational areas (OR 0.372, p=0.007). Among middle-aged adults, a higher percentage of multi-family housing (OR 1.147, p=0.029) was a positive correlate of consideration of neighborhood safety, while the number of food stores (OR 0.761, p=0.001) was a negative correlate (Table 30).

Table 30 Environmental Correlates of the Odds of Neighborhood Safety Consideration: Multivariate Analyses Controlling for Covariates by the Sample and Subsamples

Domains and variables	Total	Urban	Rural	Older	Middle-aged
Self-reported perceived safety					
Perceived safety related to traffic		1.560 (p=0.015)			
Perceived safety related to walking		0.513 (p=0.002)			
Objective measure – Greenery					
Mean of NDVIs: ranging 100 to -100		0.884 (p=0.008)			
Objective measure – Generalized land uses					
% of single family residential uses			0.939 (p=0.010)		
% of multifamily residential uses					1.147 (p=0.029)
% of commercial uses			0.852 (p=0.052)		
Presence of park/recreational uses	0.505 (p=0.017)	0.460 (p=0.027)		0.372 (p=0.007)	
Objective measure – Destinations					
Number of food stores	0.883 (p=0.010)				0.761 (p=0.001)
Number of food services		0.886 (p=0.001)			
Number of service destinations			1.204 (p=0.047)		
Akaike information criterion (AIC)	456.127	302.096	130.494	284.437	174.784
Bayesian information criterion (BIC)	491.654	335.187	160.911	303.937	196.239
Pseudo R^2	0.267	0.212	0.335	0.260	0.296

4.6 DISCUSSIONS

4.6.1 Subsample vs. Subsample: Comparisons of Subsample Characteristics

This study addressed comparisons of urban residents vs. rural residents and older adults vs. middle-aged adults which were understudied, recruiting samples from middle-sized urbanized towns and small towns, which were also rarely targeted. Therefore, it will be valuable to describe and compare participants and environments of the subsamples here, even though it is not the main purpose of this study.

Residents recruited from rural towns were older, had more non-Hispanics Whites, more educated, having college degrees, and earned lower household incomes compared to residents recruited from urban towns. Such socio-demographical differences between urban and rural residents were likely to result in differences in their attitudes (Brower, 1996; Morrow-Jones et al., 2004; Sander, 2005). These two subsamples showed no difference in utilitarian walkability consideration when choosing their neighborhoods. However, more rural residents placed an importance on attractiveness and safety of neighborhoods, while more urban residents took into consideration housing affordability. Residents recruited from urban towns reported more health problems such as obesity and physical difficulties in walking than did those from rural towns. Compared to the urban residents, rural residents were obviously engaged in higher levels of physical activity encompassing physical activities at work and walking for transportation and recreation in neighborhoods. Rural residents also spent more time looking at screens or sitting than did urban residents. This may be a result of urban residents spending more time at work and sitting at work despite similar rates of employment of those in urban and rural towns. Results also showed that urban residents earned higher household incomes. Those differences in behaviors and health status were supported by other results showing that urban residents possessed more vehicles in their households, while more rural residents had someone to walk with.

Residents from rural towns were shown to be older and more non-Hispanic Whites than those from urban towns. The subsample aged 65 years or older was also more male, White, and rural residents than the other subsample aged 50 to 64 years. On the other hand, the middle-aged adult subsample consisted of more Hispanics than the older adult subsample. Households of the middle-aged adults owned more vehicles and had more children. They also tended to prioritize housing affordability in their residential choices. No differences were found in other residential considerations between these two age groups. Rather than other demographic differences, these two age-related subsamples were likely to reflect clear differences in lifestyles derived from different lifecycle stages in terms of a child in the household, the number of vehicles, employment status, and working hours. The lifestyle preference and lifecycle stage factors were known to be closely related to residential preferences for neighborhood environments and locations (Lindberg, Hartig, Garvill, & Garling, 1992; Myers & Gearin, 2001). However, different lifestyle preferences and lifecycle stages of the two age groups did not lead to differences in residential considerations in this study except for housing affordability. More physical difficulties in walking were shown among older adults, while more obesity was shown among middle-aged adults. The only difference in behavior of older and middle-aged adults was that middle-aged adults were more engaged in physical activities at work. Accordingly, the rates of employment, hours spent at work, and the mean household incomes were greater among middle-aged adults than among older adults. Those results confirmed varying lifestyles along with different lifecycle stages, but no differences were found in the levels of walking for transportation and recreation. Subsamples from the two age groups were obviously representative of different lifestyle preferences and lifecycle stages, but the factors did not lead to differences in walking behaviors and neighborhood considerations regarding walkability and safety.

Regarding differences in neighborhood environments, results confirmed that compared to rural towns, urban towns were more compact and mixed in land use intensity and diversity, had more extensive infrastructure systems, and had higher rates of crime and crash incidences. For example, urban towns had higher intersection density (1.25 times), rates of commercial land uses (2.05 times), and density of housing units (1.63 times), compared to rural towns (Table 12). However, it is likely that perceptions of safety regarding traffic, crime, and walking were not much different between the urban subsample and rural subsample. Previous research has pointed out that mixed results in predicting physical activities can be attributed to inconsistency between objectively measured risk factors and the perception of safety due to the psychological complexity of perception (Piro, Nœss, & Claussen, 2006; Wilson, Kirtland, Ainsworth, & Addy, 2004). Neighborhood environments where middle-aged adults lived were shown to be more urbanized and compact in terms of infrastructures, crime rates, service and recreational destinations, and residential density compared to where older adults lived. Considering that this age group is more actively involved in occupations and composed of more Hispanics, it is likely that they preferred more urbanized and compact neighborhood environments (Shigematsu et al., 2009). The rates of crime incidents were higher in the neighborhoods of middle-aged adults, but the rates of crash incidents were quite the same between the age-related subsamples. The perceptions of safety related to traffic, crime, and walking were also the same between these subsamples.

4.6.2 Relationships between Walkability and Safety Considerations

Out of 113 proponents of neighborhood walkability, the majority (100 residents (88.5%)) considered neighborhood safety as well in their residential choices (Table 14). However, out of 513 proponents of neighborhood safety, the majority (413 residents (80.5%)) did not consider walkability in residential choices. Only 19.5% of proponents of neighborhood safety considered neighborhood walkability as well. The personnel accounted for only 16% out of the total (Figure 8).

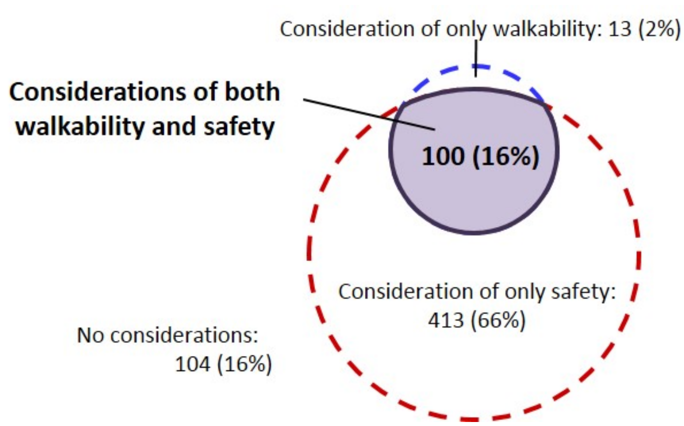

Figure 8 Relationships between Walkability and Safety Considerations

Therefore, neighborhood walkability is not likely to be much important in residential choices based on preference for neighborhood safety. In terms of residential preference for neighborhood walkability, safety consideration is likely to be an important aspect in addition to walkability consideration in residential choices (Figure 9). However, walkability was less considered with safety consideration when choosing a residence with regard to neighborhood safety. This implies that a residential preference for overall neighborhood safety and safety consideration derived from a residential preference for neighborhood walkability are not identical (Quercia, Aiello, Schifanella, & Davies, 2015). Given that a purpose of a study is only to examine more supportive environments for those who prioritized neighborhood walkability in their home purchases, addressing those who prioritized neighborhood safety is presumably independent of the study purpose. Even though neighborhood safety should be addressed as an important aspect of walkability (Alfonzo et al., 2008; Suminski et al., 2005), the overall neighborhood safety and safety consideration should be distinguished in studies on neighborhood preferences.

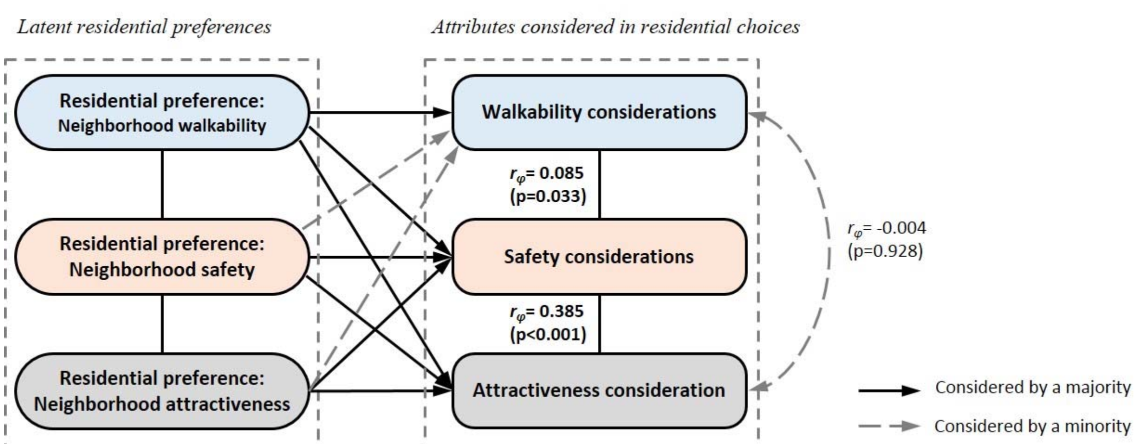

Figure 9 Conceptual Relationships between Residential Preferences and Neighborhood Considerations

4.6.3 Correlates of Neighborhood Considerations

To explore and identify correlates of neighborhood considerations, bivariate and multivariate analyses were performed. The analyses were performed with the total sample and four subsamples. Due to complexity in discussing results from those analyses, this section specifies the sample or subsamples by initials when referring to corresponding relationships. That is, (T) refers to the total sample, (U) for the urban subsample, (R) for the rural subsample, (O) for the older adult subsample, and (M) for the middle-aged subsample.

4.6.3.1 Personal, Household, Community Characteristics

The results were closely related to a research question: "Who considered neighborhood walkability or safety in their residential choices?" From multivariate analyses, three personal demographical factors, two attitudinal or activity factors, and three household characteristics were identified as predictors of the odds of neighborhood walkability consideration across the sample and subsamples (Table 32). White (T, U, R, M), obese (R, O), educated residents (R), residents having more vehicles (T), having a child (M), or living close to CBDs (T, U, R, O, M) were less likely to consider neighborhood walkability in their residential choices, while utilitarian walkers (T, R, O), proponents of neighborhood safety (T, R, M), or long-term residents (T, R, O) were more likely to consider neighborhood walkability. In predicting the odds of neighborhood safety consideration, one personal demographic factor, four attitudinal or activity factors, and two household or community characteristics were identified. Hispanics (U, M), older adults (R), residents engaging in more sedentary activities (R), or long-term residents (T, U, O) were less likely to consider neighborhood safety in their residential choices, while utilitarian walkers (T, R), housing affordability proponents (T), neighborhood attractiveness proponents (T, U, R, O, M), or rural residents (T, O, M) were more likely to consider neighborhood safety (Table 32).

When it comes to race or ethnicity, non-Hispanic White residents were more likely to disregard neighborhood walkability, while Hispanic residents were more likely to disfavor neighborhood safety in their residential choices. Related to residential location choices, many studies have found non-White households more likely to live in city locations than White households (Sander, 2005). A study found that a traditional design of neighborhoods characterized by mixed-land uses and high pedestrian connections were more strongly supported by non-White respondents than White respondents (Handy et al., 2008). Residents with lifestyles where they had lower educational attainments, fewer vehicles, or no children were more likely to consider neighborhood walkability. Residents at a lifecycle stage where they were married or middle-aged were more likely to consider neighborhood safety. Previous studies found that people with more years of education or college graduate/more education were more amenable to compact community development (Handy et al., 2008; Morrow-Jones et al., 2004). However, this study proposed that focusing on utilitarian walkability residents who were college graduates or had more education were less likely to place an importance on neighborhood walkability among total, rural, and middle-aged residents.

Regarding residential preference for neighborhood attributes, multivariate results showed that rural residents who considered neighborhood safety were 11.4 times more likely to consider neighborhood walkability than those not considering safety (Table 27). Bivariate results supported the associations found in the total sample and rural subsample (Table 31). Those results confirmed again that walkability preference involved considerations of walkability and safety in the previous section (section 4.6.2). Across all sample and subsamples, bivariate and multivariate results demonstrated that neighborhood attractiveness consideration was positively associated with the odds of neighborhood safety consideration. Specifically, rural residents who considered neighborhood attractiveness were 20.1 times more likely to consider neighborhood safety than their counterpart in a multivariate model (Table 28). The results supported that safety preference resulted in considerations of safety and attractiveness (Giles-Corti & Donovan, 2002). In addition, the housing affordability was an important factor among proponents of neighborhoods safety in the total sample. It might be because those who at a lower SES were more sensitive to safety issues in the disadvantaged environments where they lived (Hooker, Wilson, Griffin, & Ainsworth, 2005).

Multivariate relationships indicated that obesity was a significant health-related correlate of walkability consideration among rural residents and older adults. This showed that disregarding neighborhood walkability in residential choices was attributed to obesity rather than difficulty in walking among rural and older adult populations (Ball, Crawford, & Owen, 2000). Analyses also found bivariate relationships where walking difficulties were negatively related to safety consideration in the rural resident and older adult subsamples (Table 31). These findings implied that those with health problems in the obesity and mobility were less interested in neighborhood spaces in terms of walkability and safety (Rimmer, 2005). In terms of activities, utilitarian walking was shown to be positively associated with both walkability consideration and safety consideration in the total sample and rural subsample (Table 32). This demonstrated that predispositions for neighborhood walkability, which underlay walkability and safety considerations, led to walking (Lund, 2006; Schwanen & Mokhtarian, 2007). A sedentary lifestyle captured by hours on screen or hours sitting was negatively associated with consideration of safety. A physical activity at work was a positive correlate of walkability consideration and recreational walking was a positive correlate of safety consideration in bivariate relationships.

The length of residence was shown to be positively associated with walkability consideration in the total sample, urban subsample, and rural subsample, while it was negatively correlated with safety consideration in the total sample and rural subsample (Table 32). This implied that long-term residents were more likely to consider neighborhood walkability, while short-term residents were more likely to consider neighborhood safety when they purchased homes. It might be because the long-term residents took into considerations walkable neighborhoods as environments where they would live for a long time, while neighborhood safety was likely to be an important issue for new comers (Schulz et al., 2006). Furthermore, the comparisons of subsamples showed that the older adult subsample obviously had a longer residence time than did the middle-aged adult subsample (Table 11). However, age was not attributed to neighborhood considerations. Rather, older adults were less likely to consider walkability and safety in rural towns in bivariate relationships (Table 31).

Table 31 Bivariate Associations between Neighborhood Considerations and Personal/household Characteristics: A Summary Table

Domains and variables	Walkability					Safety				
	T	U	R	O	M	T	U	R	O	M
Personal - demographics										
Gender: Male (ref= female)										
Age: ranging 50 – 92 years										
65 years or older (ref= < 65)			-					-		
70 years or older (ref= < 70)										
Hispanic, Latino or Spanish origin (ref= others)	+		+	+	+	-	-			-
Race: non-Hispanic, White (ref= others)	-	-	-		-					
Obese: BMI>=30 (ref= non-obese (BMI<30))				-						
Marital status: Married (ref= unmarried)							+			
Education level: some college or higher (ref= lower than some college)	-		-		-					
Employment Status: for wages/self-employed (ref= unemployed)										
Working hours per week										-
Personal – attitudes and activities										
Housing affordability consideration			+					+		
Attractiveness consideration						+	+	+	+	+
Walkability consideration						+		+		
Safety consideration	+		+							
Any difficulty in walking (ref= no difficulty)						-		-	-	
Someone to walk with (ref= no one)						+			+	
PA at work: standing/walking/heavy labor (ref= no work/sitting)	+	+			+					
Screen/sitting hours per week								-		
Walking for all purposes per week: 150+ min. (ref: 0-149 min.)						+		+	+	+
Walking for transportation per week: 1+ min. (ref: 0 min.)	+		+	+	+	+		+	+	+
Walking for recreation per week: 150+ min. (ref: 0-149 min.)						+		+	+	
Household characteristics										
Length of residence	+		+	+		-	-	-	-	
Number of vehicles in your household	-				-					
Number of children				+						
Presence of children in household				+						
Annual household income	-				-		+			
Annual household income (>=$50k)	-	-			-					
Community settings and home locations										
Community setting: rural town (ref= urban town)					+	+			+	+
Proximity to CBDs	+	+	+	+	+		+			

T total sample; U urban subsample; R rural subsample; O older adult subsample; M middle-aged subsample; + associated positively; and - associated negatively at a significance level of 0.05.

Analyses found bivariate and multivariate relationships where the closer distance to a CBD was a positive correlate of walkability consideration, while rural town location was a positive correlate of safety consideration across the total sample and subsamples (Table 32). Specifically, within the older adult sample, both relationships (with distance to CBDs and home locations) were found from multivariate analyses. It demonstrated that residents living closer to CBDs were more likely to consider walkability, while those living in rural towns were more likely to consider safety. The results may be derived from the process where town centers had been formed along with mass transit systems or highways. Such formations of towns located a few blocks of residences concentrated in the centers (Burchell et al., 2002). Across the total sample and age-related subsamples, residents preferred rural towns to urban towns in terms of neighborhood safety consideration. From literature addressing associations between perceived safety and the levels of physical activities, rural towns were perceived as safer from crimes and traffic than urban towns. However, urban towns were perceived as safer regarding sidewalks, street lights, and unattended dogs (Parks, Housemann, & Brownson, 2003; Wilson et al., 2004).

Table 32 Personal and Household Predictors of Neighborhood Considerations: A Summary of Multivariate Relationships

Domains and variables	Walkability					Safety				
	T	U	R	O	M	T	U	R	O	M
Personal - demographics										
Hispanic, Latino or Spanish origin (ref= others)							-			-
Race: non-Hispanic, White (ref= others)	-	-*	-		-					
Obese: BMI>=30 (ref= non-obese (BMI<30))			-	-						
Education level: some college or higher (ref= lower than some college)			-							
Personal – attitudes and activities										
Housing affordability consideration						+				
Attractiveness consideration						+	+	+	+	+
Safety consideration	+		+		+					
Screen/sitting hours per week								-		
Walking for transportation per week: 1+ min. (ref: 0 min.)	+		+	+		+		+		
Household characteristics										
Length of residence	+		+	+		-	-	-*	-	
Presence of children in household					-					
Community settings and home locations										
Community setting: rural town (ref= urban town)						+			+	+
Proximity to CBDs	+	+	+	+	+					

T total sample; U urban subsample; R rural subsample; O older adult subsample; M middle-aged subsample; + associated positively; and - associated negatively at a significance level of 0.05; *: a significance at 0.1 level.

4.6.3.2 Environmental Correlates of Neighborhood Considerations

The purpose of discussing environmental correlates of neighborhood considerations here was to depict neighborhood environments which were chosen based on walkability consideration or safety consideration. Two perceived safety factors and seven objective measures encompassing land use (3 factors) and destination (4) attributes were identified as predictors of the odds of neighborhood walkability consideration across the sample and subsamples from multivariate analyses (Table 34). Neighborhood environments with higher perceived safety from traffic (T, R, O), more civic land uses (M), food stores (T, U, O), food services (R, M), shopping malls (T, U, O), or educational service destinations (U) were more likely to be considered as walkable, while those with higher perceived safety for walking (R, M), more single family residential uses (O), or industrial uses (U, O) were less likely to be considered as walkable. In predicting the odds of neighborhood safety consideration, the multivariate relationships included two perceived safety correlates and seven objectively measured environmental correlates encompassing greenery (1 factor), land use (3), and destination (3) attributes. Neighborhood environments with higher perceived safety from traffic (U), more multifamily residential uses (M), and service destinations (R) were more likely to be considered as safe, while those with higher perceived safety for walking (U), more greenery (U), single family residences (R), park/recreational uses (T, U, O), food stores (T, M), or food services (U) were less likely to be considered as safe (Table 34).

Perceived safety related to traffic and perceived safety related to walking were found as correlates of both walkability and safety considerations in a multivariate relationship. Perception of safety from traffic (e.g. low traffic, the presence of crosswalks or signals, slow speeds of traffic) was a positive correlate of neighborhood considerations across the total sample and all subsamples except the urban subsample, while perception of walking-related safety (e.g. the presence of sidewalks, adequate sidewalks, few unattended dogs) was a negative correlate of neighborhood considerations among the urban subsample. A bivariate relationship was found where the perception of safety from crime (e.g. well lit, many people, neighbors could be counted on) was a positive correlate of safety consideration among middle-aged adults (Table 33). Those three categories of safety-related items have been shown to be connected to higher levels of physical activities in the literature (Bracy et al., 2014; Foster & Giles-Corti, 2008). However, availability and maintenance of sidewalks and control of stray animals were perceived as inadequate among the consideration groups. It was likely that those who considered walkability and safety were more sensitive to the problematic conditions of pedestrian infrastructures and control of stray animals, and were more caring about the common spaces of their neighborhoods. A few previous studies have claimed an awareness issue related to walking to school among elementary-aged children (Lee, Yoon, & Zhu, 2016; Lee, Zhu, Yoon, & Varni, 2013). The studies found that parental respondents whose children commuted to school by walking were likely to have more chances to be aware of the inadequateness in provision or maintenance of non-motorized transportation facilities (e.g. sidewalks, bike lanes, walking paths).

No significant multivariate relationship was found among infrastructures, crimes/crashes, and residential and employment density with neighborhood considerations. However, bivariate relationships showed all factors which were involved in pedestrian infrastructures, street connectivity, transportation infrastructures, crime and crash incidents, and residential and employment density were positively associated with walkability consideration, but negatively associated with safety consideration across the total sample and subsamples. Similar bivariate relationships of neighborhood destinations were found with neighborhood considerations, but some destination variables were shown to be correlates of neighborhood considerations in multivariate relationships. Such results may be derived from the home locations within towns and varying development patterns by community settings which were representative in describing those environmental attributes. Previous studies have employed composite indices to capture walkability of neighborhoods or community types (e.g. urban vs. suburban) to represent neighborhood attributes in matching residential preferences and environments (Frank et al., 2007; Schwanen & Mokhtarian, 2005a, 2005b). However, this study was performed to explore specific environmental features underlying walkability consideration and safety consideration which were understudied in the previous research.

In addition to influences of home locations and development patterns, multivariate relationships showed that neighborhood destinations such as food stores, food services, shopping malls, and educational services were positive correlates of walkability consideration, while food stores and food services were negative correlates of safety consideration. Food stores (supermarkets, retail food stores, and convenience stores) were shown to be the most popular destination chosen by proponents of walkability from three subsamples except the middle-aged sample, while the places were avoided by proponents of safety from the middle-aged sample. Neighborhoods with food services (traditional restaurants, fast-food restaurants, pizza places, and snack/drinking places) were chosen by rural residents and middle-aged adults for walkability consideration, while the places were avoided by urban residents for safety consideration. Neighborhood environments with a shopping mall were also chosen by proponents of walkability among urban residents and older adults. The same types of destinations played different roles in neighborhood considerations by age, community settings, and considered attributes. Such different roles by these groups can be found in studies on physical activity (Saelens & Handy, 2008). For example, restaurants played a positive role for utilitarian walking in metropolitan urban areas, while a negative role in small towns (Stewart et al., 2016). Another study found that proximity to destinations such as restaurants or retail stores was associated with increased walking for transportation and recreation among adults aged 50 – 75. However, the proximity to destinations was not related to the walking of the early middle-aged group (aged 40-49) or older adult group (aged ≥76) (Shigematsu et al., 2009).

Civic land uses was a positive, and single family residential and industrial land uses were negative correlates of walkability consideration across the subsamples. Bivariate relationships supported their choices of neighborhoods with more multifamily residences, commercial, and civic uses and fewer single family residential uses (Table

33). For safety consideration, single family residences and parks/recreational spaces were negative correlates for rural residents. Multifamily residential land uses was a positive correlate of safety consideration for middle-aged adults. It implies that single family detached housing environments were perceived as unsafe for a certain group of people, but gated multifamily housing environments were perceived as safe for another group (Hirt & Petrović, 2010). Among older adults, those considering walkability chose communities with fewer single family and industrial uses, while those considering safety selected communities with fewer park/recreation uses. Even by older adults, single family detached housing environments were not preferred when choosing walkable neighborhoods. As well, parks or open spaces were not preferred by older adults considering safety. Urban residents considering safety also chose neighborhood environments with fewer park/recreation uses as well as fewer green spaces. This implies that green spaces and lands for recreational uses were likely to be perceived as unsafe spaces for urban residents and older adults. Previous research has pointed out that enclosed or abandoned green spaces could be a cause for the decrease in the perception of safety among vulnerable groups such as females and older adults as well as in intensively urbanized areas (Herzog & Flynn-Smith, 2001; Jorgensen & Anthopoulou, 2007; Maas et al., 2009).

Table 33 Bivariate Associations between Walkability Considerations and Environmental Factors: A Summary Table

Domains and variables	Walkability					Safety				
	T	U	R	O	M	T	U	R	O	M
Self-reported perceived safety										
Perceived safety related to traffic	+		+	+		+	+			
Perceived safety related to crime										+
Perceived safety related to walking	-				-					
Overall perceived safety										
Objective measure - Infrastructures										
Presence of crosswalks	+	+	+	+	+	-				
Intersection density	+		+		+	-			-	-
Sidewalk completeness	+		+	+	+					
Presence of railroad			+		+	-	-		-	-
Presence of highway	+	+			+				-	
Objective measure – Greenery										
Mean of NDVIs: ranging 100 to -100	-	-				+				+
Objective measure - Crime and crash										
Yearly violent crimes	+	+	+			-			-	-
Yearly property crimes	+	+	+	+		-	-		-	-
Yearly behavioral crimes	+	+	+	+	+	-	-		-	-
Yearly total crimes	+	+	+	+		-	-		-	-
Number of sex offenders	+		+		+	-	-	-	-	-
Yearly pedestrian/cyclist crashes	+	+	+	+	+	-	-		-	-
Yearly vehicle crashes	+	+	+	+	+	-	-		-	-
Yearly total crashes	+	+	+	+	+	-	-		-	-
Objective measure - Generalized land uses										
% of single family residential uses	-		-				+			
% of multifamily residential uses	+		+		+					
% of commercial uses	+	+	+	+	+	-	-		-	-
Presence of industrial use			+			-				-
Presence of civic use		+			+	+			+	
% of agricultural uses	-	-			-					
Presence of park/recreational use			+			-			-	
% of undeveloped lands	-		-			+			+	+
Objective measure- Destinations										
Number of food stores	+	+	+	+	+	-	-		-	-
Number of food services	+	+	+	+	+	-	-		-	
Number of drug stores and video services	+	+	+	+	+	-	-		-	
Presence of shopping malls	+	+	+	+	+					
Number of service destinations	+	+	+	+	+	-	-		-	-
Number of community service destinations	+		+		+	-			-	
Presence of educational service destinations	+	+	+	+	+	-				
Objective measure – Density										
Single family housing: 100 units						-	+			
Multi-family housing: 100 units	+		+						-	
Total housing: 100 units						-			-	
Parcels with large businesses	+	+	+	+		-	-		-	-
Employees in large businesses: 100 employees	+		+	+		-	-		-	-

T total sample; U urban subsample; R rural subsample; O older adult subsample; M middle-aged subsample; + associated positively; and - associated negatively at a significance level of 0.05.

Table 34 Self-reported and Objectively Measured Environmental Predictors of Neighborhood Considerations: A Summary of Multivariate Relationships

Domains and variables	Walkability					Safety				
	T	U	R	O	M	T	U	R	O	M
Self-reported perceived safety										
Perceived safety related to traffic	+		+	+			+			
Perceived safety related to walking			-		-		-			
Objective measure – Greenery										
Mean of NDVIs: ranging 100 to -100							-			
Objective measure - Generalized land uses										
% of single family residential uses				-				-		
% of multifamily residential uses										+
% of commercial uses								-*		
Presence of industrial use		-		-						
Presence of civic use					+					
Presence of park/recreational use						-	-		-	
Objective measure- Destinations										
Number of food stores	+	+	+*	+		-				-
Number of food services			+		+		-			
Presence of shopping malls	+	+		+						
Number of service destinations								+		
Presence of educational service destinations		+								

T total sample; U urban subsample; R rural subsample; O older adult subsample; M middle-aged subsample; + associated positively; and - associated negatively at a significance level of 0.05; *: a significance at 0.1 level.

4.6.4 Limitations

This study contains several limitations. Current environmental attributes were used to compare with neighborhood considerations for neighborhood quality when residents chose residential locations. Thus, this study attempted to cover the gaps by creating proxy measures based on the length of residence and controlling the changes. However, the length of residence itself was more effective than the proxy measures in modeling across the total sample and subsamples. This study employed the datasets from two different projects utilizing different survey methods (i.e. phone vs. mail/online) and sampling methods (i.e. random sampling based on residential parcels vs. nonprobability sampling based on a hospital’s patient database). To reduce problems from the differences, adjustments for data were incorporated to correct biases by matching sample frames. Six to nine years of cumulative crime and crash data were utilized to capture safety risks in neighborhoods. The crash data were obtained from one source from the state government, so that the data were consistent between cities and qualified. However, because of varying service conditions in managing data of local police departments where the crime data was collected, there were large variations in the number of incidents between cities and data were unavailable from one of the rural towns. To adjust for variations in incidents, a yearly average of incidents per square kilometer were employed for the units of measure. The city of Bay City, where the crime data was unavailable, was excluded from analyses of this study. This was a cross-sectional study, thus this study could not rule out threats to causal validity where the influence of unmeasured factors was plausible and attitudes were able to change over time, even though this study attempted to alleviate drawbacks prompted from time gaps. Due to unmeasured variables from one or both surveys, a few variables (e.g. family size, driving miles, attitude toward recreational walking, perceptions of walking environments) which might be necessary for conceptual frameworks of neighborhood considerations and residential location choices were not included in the estimations. But, the current study employed relevant variables such as consideration factors, perceived safety factors for walking, the number of vehicles and children, and marital status.

4.7 CONCLUSION

This dissertation study identified who considered walkability or safety when choosing their neighborhood and what environmental features are preferred by the proponents of neighborhood walkability or safety for residential choices. This study also examined how such personal/household and environmental factors differed by community setting and the ages of the subsamples. The findings of the investigations are summarized here.

First, this study employed subsamples whose differences in neighborhood considerations and choices have not been fully understood in the literature. Comparisons of urban and rural subsamples showed obvious differences underscored by varying lifestyle preferences (automobile and walking orientations). Urban residents had more health problems (obesity and walking difficulties) and larger household incomes, worked more hours, considered housing affordability, had more vehicles, but lived closer to CBDs. Rural residents were older, more non-Hispanic Whites, educated, engaged in more physical activities, and took neighborhood attractiveness and safety into consideration more often. Older and middle-aged adult subsamples demonstrated clear differences in lifecycle stages. Older residents were more White, had more trouble walking, were not engaged in occupation activities, and resided for longer periods in rural towns. Middle-aged residents were more Hispanic, eager in job activities but obese, raising children, had more vehicles, earned a higher income, and resided in urban towns. Neighborhoods in urban towns and where middle-aged adults lived were comparatively compact and mixed in land use intensity and diversity, had extensive infrastructure systems, and had higher rates of crime and crash incidences. Nonetheless, urban residents were inactive even for utilitarian walking and more automobile oriented rather than were rural residents.

Second, this study examined latent preferences for neighborhood attributes underlying neighborhood considerations for residential choices. People who have a residential preference for neighborhood walkability tend to consider walkability as well as safety when they choose residences. However, neighborhood walkability was less considered when people prioritized neighborhood safety. Rather than walkability, people who have a preference for neighborhood safety are more likely to consider neighborhood attractiveness along with safety. This finding provided an insight for how walking-related safety and overall neighborhood safety can be distinguished in terms of residential preference, and the links between preferences for neighborhood attributes and considered attributes for residential choices.

Third, the correlates of walkability and safety considerations were identified. Across the sample and subsamples, proponents of walkability were likely to be non-White, pro-safety, utilitarian walkers, non-obese, less educated, without a child, and long-term residents residing closer to CBDs. Proponents of safety tended to be non-Hispanic, pro-affordability and attractiveness, utilitarian walkers, less sedentary, and short-term residents residing in rural towns. Neighborhoods considered as walkable included high perceived safety from traffic but low safety for walking, more civic land uses, destinations (foods, shopping malls, and education), fewer single family residences, and industrial areas. Neighborhoods considered as safe had a high perceived safety from traffic but low safety for walking, more multifamily residences, service destinations, fewer single family residences, park/recreational land uses, food stores, and food services.

Rural or older residents who were walkability proponents were non-obese, less educated, utilitarian walkers who had lived for a long time in their current residences. Safety proponents who were rural or older residents were utilitarian walkers spending less time in sedentary activities. Unlike them, race/ethnicity and raising children were related to neighborhood considerations of urban and middle-aged residents. For urban residents, more schools or the associated were unique environmental correlates of walkability consideration, while fewer green/vacant spaces and food services were correlates for safety consideration. An increase in food services was a unique factor related to the odds of walkability consideration of rural residents, while fewer single family residences and more service destinations were unique for safety. Single family detached housing environments were barriers to walkability consideration of older residents. For middle-aged residents, civic land uses and multifamily residences played unique and positive roles on walkability and safety considerations respectively.

Understanding the nature of understudied population groups can pave the way for future research which aims to understand behaviors of various population groups as well as explore their different housing demands. Future research is also necessary to address neighborhood safety as an important facet of walkability, but should be distinguished from the preference for overall safety and consideration of walking-related safety. This study provides an insight into the existing literature and housing markets by focusing on willingness-to-live for walkable and safe environments to understand what objectively measured environmental features were chosen by different groups of customers. The findings of this study present substantial information on housing demands of different groups of customers with different perspectives for walkable environments and safe environments. The environmental characteristics such as land uses, destinations, and perceived safety are differently valued by various groups of people according to their housing demands. These suggested that tailored locational and design approaches and policies should be initiated to develop community venues which meet the various demands.

CHAPTER V

STUDY TWO: WALKING, NEIGHBORHOOD SAFETY, AND NEIGHBORHOOD LIVABILITY – THE ROLE OF NEIGHBORHOOD DISCORDANCE

5.1 CHAPTER SUMMARY

Previous studies have documented links between community environments and travel behaviors such as travel mode share and walking behaviors. Preferences for walking underlying residential location choices are believed to modify the associations between built environments and walking behaviors. However, only a small number of studies have examined the interrelationships between objectively evaluated neighborhood quality and residential preferences for walkable neighborhoods. Furthermore, little is known about how concordance and discordance between objective neighborhood qualities and neighborhood considerations affect walking behaviors. This study aims to examine the walking behaviors, perceived safety, and livability of those who live in a condition called "neighborhood discordance", defined as the mismatch between the preferred versus actual/current neighborhood environments. This study further separately tests the roles of neighborhood discordance in urban versus rural environments and among older vs. middle-aged adults, as previous studies have shown the varying roles of neighborhood environments across different community settings and age groups.

Using the survey and GIS datasets (n=630 respondents) from two recently completed research projects, one conducted in two rural towns and the other in four urban towns in Texas, this study examined the potential associations that neighborhood discordances (walkability and safety) might have with (a) walking for transportation, (b) perceived safety, and (c) livability. Using GIS techniques, neighborhood walkability and safety were systematically evaluated in terms of infrastructure, greenery, crime and crash risks, destination land uses, and density, which were objectively measured within a 1km sausage network buffer from each respondent's home. Multilevel modeling approaches were considered to account for the nested data structure at the town level and the community setting level. Multiple path models were established to examine the hypothesized relationships among the study variables and their direct and indirect pathways between neighborhood discordances and the three outcome variables (walking, perceived safety, and livability) using generalized structural equation modeling (GSEM) techniques. Statistical significance was identified at a 0.05 level, and all analyses were performed on the total sample (n=630), and urban (n=294), rural (n=336), older (≥65 years; n=366), and middle-aged (50-64 years; n=264) subsamples.

Both preference discordance (having no walkability preference but living in walkable neighborhoods) and walkability discordance (having a walkability preference but living in non-walkable neighborhoods) were negatively associated with walking for transportation among the rural subsample, while only the preference discordance was negatively correlated with walking among the total sample and older adult subsample. For safety, safety discordance (having a safety preference but living in unsafe neighborhoods) was linked to lower perceived safety among the total sample and urban subsample. However, preference discordance (having no safety preference but living in safe neighborhoods) was linked to a higher safety perception among the urban and older adult subsample. It may be due to the possibility that residents who did not have a safety preference may not have high expectations for the actual safety conditions, leading to high levels of perceived safety given similar objective conditions. Discordances did not play any significant role for walking among the urban and middle-aged subsample, and for safety among the rural and middle-aged subsample.

Age, race/ethnicity, SES (e.g. education, the number of vehicles), the length of residence, and residential preference for neighborhood attractiveness were the most common personal/household predictors of neighborhood discordances across samples. Traffic and walking related perceived safety, objectively measured pedestrian infrastructures (e.g. crosswalks, sidewalks), street connectivity, crime and crash rates, and employment density were common environmental correlates of discordances. Perceived livability was a function of SES, attitudes toward walkability and safety, walkable neighborhood environments, walking for any purpose, and perceived safety.

Through a comprehensive examination of the links among residential choices, residential preferences, walking behaviors, and perceived safety and livability, this study suggests the importance of being able to select a neighborhood that matches an individual's residential preference. An adequate supply of walkable neighborhoods can bring intended benefits, especially when properly matched with the population that prefers living in walkable neighborhoods. Furthermore, this study provides additional insights on the dynamic relationships among residential preference, walking, safety, and livability.

5.2 INTRODUCTION

As efforts to reduce dependence on the automobile and resolve many social and economic problems, planners and policy makers have agreed to support encouraging development conducive to non-motorized travels such as walking, bicycling, and transit uses (Boarnet & Crane, 2001; Crane, 2000). A wave of literature has documented links between community environments and travel behaviors such as non-motorized mode share and walking behaviors (Ewing & Cervero, 2001, 2010). Numerous empirical studies and systematic reviews have reached a consensus about certain built environmental characteristics of origins, destinations, and routes between them associated with specific travel behaviors (Cervero & Kockelman, 1997; Lee & Moudon, 2004). Through a large number of previous studies, walking-oriented community settings have been defined as compact developments with high densities, mixed land uses with intensity and diversity, and direct street patterns, which contribute more to active travels and neighborhood walking (Saelens & Handy, 2008; Saelens, Sallis, & Frank, 2003).

Later, a growing number of studies have focused on attitudinal factors which were able to modify associations between built environment characteristics and travel behaviors that have been evident from the body of literature (Litman, 2005). Attitudes toward a travel mode and a residential location have been issued as potential determinants of walking or active behaviors of individuals in addition to built and social environmental factors in the travel behavior research field (Handy, 2005; Humpel, Owen, & Leslie, 2002). Residential choices are linked to personal attitudes, which include predispositions of individuals preferring a certain residential location encouraging a particular travel behavior (Litman, 2005). People who have a preference for a certain travel mode and land use probability are able to self-select residential locations to realize their preferred behaviors or desired life styles (Bell, 1958; Brun & Fagnani, 1994). Accordingly, if the self-selected built and social environments entirely account for variations in travel behaviors at a community level, policies and research should focus on shifts of personal attitudes toward active travels and residential locations conducive to performing active behaviors (Handy, 2005). However, general findings from this body of literature are that residents decide residential locations or their neighborhoods partially considering their preferences as well as built environments are also independently taken into account for travel mode choices (Cao et al., 2008, 2009). Most previous studies from transportation and public health literature have examined whether there is a link between built environments and individuals' walking behaviors after controlling for the residential self-selection effects (Mokhtarian & Cao, 2008). Although the general findings show both residential self-selection and built environment independently explicate travel behaviors, interrelationships between the built environments and the neighborhood attributes considered in residential selections are little known (Cao et al., 2009; Handy, 2005).

Only a small number of studies have examined the interrelationships between objectively evaluated neighborhood quality and residential preferences for walkable neighborhoods (Frank et al., 2007; Schwanen & Mokhtarian, 2007; Van Dyck, Cardon, Deforche, Owen, et al., 2011). A small group of studies addressed the concordance between current community types and attitudes of residents, and how the discordance moderated the environment-travel relationships (Frank et al., 2007; Schwanen & Mokhtarian, 2005b). These studies were designed to examine which attitudinal and built environmental factors possessed the relatively higher strength to account for travel behaviors. They achieved the research objectives with comparisons of travel miles or travel mode choices between consonance and dissonance groups, matching desired and current neighborhood types where the resident participants currently lived (Frank et al., 2007; Schwanen & Mokhtarian, 2005a, 2005b). Their findings concluded that both attitudinal and built environmental factors independently influenced travel behaviors, with the neighborhood type dissonances limiting desired behaviors of residents. The studies examined a link between desirable and current neighborhood types. However, using the measurements of stated preferences to capture desired residential areas might result in confusing the current desires with the neighborhood preferences considered for residential choices. In addition, study areas of the researches were limited to urban neighborhoods and suburban neighborhoods in metropolitan areas.

While previous research has addressed a cognitive dissonance between current attitudes and neighborhood types, there is still a shortage of studies which address the interrelationships between the objective measures of built environments and neighborhood walkability considerations, which are neighborhood preferences considered in neighborhood choices for walkable and safe neighborhoods. Thus, it is questionable whether the “neighborhood discordance” between expectations and reality in neighborhood choices operate as a loss of expected utility constraining the desired levels of behaviors and neighborhood satisfactions, or merely as socio-demographical variations in neighborhood choices meeting the demands. Comparing the levels of walking behaviors, neighborhood safety, and neighborhood satisfactions between neighborhood concordance and discordance groups, and identifying the underlying personal and environmental factors of the neighborhood discordance will be helpful in filling the research gaps. In terms of neighborhood walkability and safety, this study aims to contribute to a comprehensive understanding of the links among neighborhood choices, neighborhood preferences, walking behaviors, neighborhood safety, and neighborhood satisfaction.

Therefore, this study mainly aims to establish conceptual frameworks to explain how neighborhood environments, neighborhood preferences, and neighborhood discordance operate in walking behaviors, perceptions, and neighborhood livability. Specifically, this study examines 1) the relationships between neighborhood considerations and objectively measured environmental features; 2) if neighborhood discordance is associated with specific personal and/or environmental factors; and 3) if the neighborhood discordance has an independent influence on walking behaviors, perceived safety, and perceived neighborhood livability.

5.3 CONCEPTUAL FRAMEWORK AND AIMS

This study included three aims (Figure 10).

Aim 1. To examine the relationships between neighborhood considerations and objectively measured environmental features of the current neighborhood

Aim 2. To explore if neighborhood discordance is associated with specific personal and/or environmental factors; and

Aim 3. To examine if the neighborhood discordance has an independent influence on walking behaviors, perceived safety, and perceived neighborhood livability.

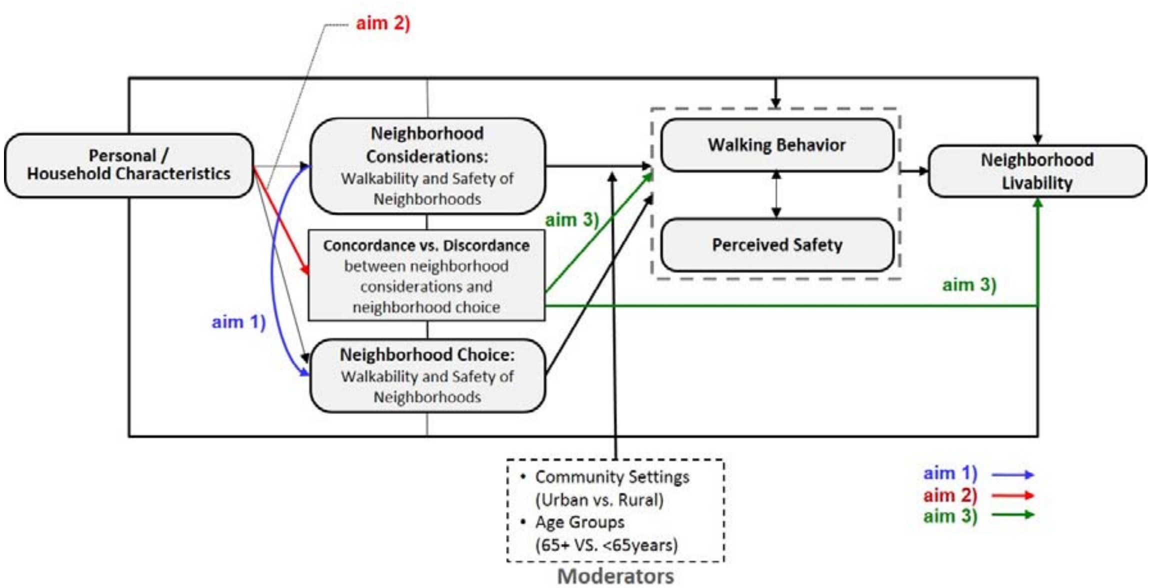

Figure 10 A Conceptual Framework for Study 2

Hypothesis 1. Neighborhood considerations will influence neighborhood choice.

Hypothesis 2. Personal and environmental predictors of neighborhood discordance will differ by (a) age groups and (b) community settings.

Hypothesis 2a. Urban residents living with neighborhood discordance are more likely to perceive risks from traffic and crime than rural residents.

Hypothesis 2b. Younger adults living with neighborhood discordance are more likely to be in lower income levels, while older being adults in lower levels of educational attainment.

Hypothesis 3. Neighborhood considerations, choices, and discordance will have an independent impact on (a) walking behaviors and (b) perceived safety.

Hypothesis 4. Residents living with neighborhood discordance are likely to (a) walk less, (b) perceive lower levels of safety, and (c) perceive low levels of livability in their communities than residents living with neighborhood concordance (Figure 10).

5.4 METHODS

5.4.1 Study Design and Study Settings

This is a cross-sectional study to examine the discordance between desired and actual neighborhood environments and its effects on walking behaviors and perceptions across different population groups. For this study, subsamples were drawn from two recently completed research projects. The Small Town Walkability (STW) project survey was conducted in 2011-2012 in two rural towns: Kerrville and Huntsville, Texas (Doescher et al., 2014). The Neighborhood Environment, Physical Activity, and Quality of Life (NPQ) study survey was completed in early 2014 in four urban towns: Bryan, College Station, Killeen, and Temple, Texas (Forjuoh et al., 2017; Ory et al., 2016). This dissertation study was performed with the total sample (n=630), and four subsamples:

urban (n=294), rural (n=336), older (n=366), and middle-aged (n=264). The urban subsample was comprised of residents from the four urban towns where the NPQ project was carried out. The rural subsample was composed of residents from the two small rural towns where the STW project was conducted. The total sample was generated from a combination of the urban subsample and rural subsample. A threshold to divide the total sample into two age groups was established at 65 years as an age involving significant changes in life (Cicirelli, 2002; World Health Organization, 2002). Thus, respondents who were 65 years or older were classified as the older adult subsample, and those who were younger than 65 years yet 50 years or older were sorted into the middle-aged adult subsample. From GIS data of this study, all values of citywide objective measures were definitely higher in urban towns compared to rural towns in pedestrian infrastructure, intersection density, crime and crash rates, number of destinations, and densities, except for greenery captured by NDVIs (mean×100: 18.42 in urban towns and 20.33 in rural towns). For example, the numbers of violent crimes per kilometer which were reported yearly were 9.42 in urban towns, while 1.99 in rural towns.

Refer to Chapter III for more details about the study setting and data collection methods.

5.4.2 Study Variables

The study variables employed for analyses encompassed: 1) walking for transportation and walking for recreation, 2) personal demographic variables, 3) personal activity and attitude variables, 4) household characteristics, 5) perceived neighborhood environment variables, and 6) objectively measured built environment and incident variables. Personal and household characteristics, activity, attitude, and perception variables were obtained from the datasets of the STW and the NPQ study surveys. Objectively measured variables were from datasets produced using the GIS.

5.4.2.1 Walking Behaviors and Perceived Safety: Primary Outcome Variables

Walking behaviors for recreation or exercise purposes and transportation purposes were collected from both the STW and NPQ surveys, which measured the number of days and minutes per day that were dedicated to walking in a typical week, self-reported by respondents. The minutes per day multiplied by the number of days were computed as the walking minutes per week for each purpose. Because recreation walking included only a small portion of non-walking (20.4% in urban towns and 9.8% in rural towns), the walking minutes per week were dichotomized into two levels of walking: a low level of recreational walking (0-149 minutes), and a high level of recreational walking (150 minutes or greater). Due to a higher portion of non-walkers (83.6% in urban towns and 38.7% in rural towns), utilitarian walking was translated into the odds of walking (i.e. walker vs. non-walker) (Moudon et al., 2006). Walking for any purpose was utilized as a key mediator in estimating neighborhood livability. The walking for any purpose was likely to be more suitable than walking for a single purpose (i.e. walking for transportation, walking for recreation) to conceptualize the relationships between walking and livability at a community level (Lovejoy et al., 2010). Trichotomized utilitarian and recreational walking (0, 1-149, and 150 minutes or greater) were tabulated with three-by-three cells to understand the patterns of walking behaviors between utilitarian and recreational purposes (Table 35). Because of one of the cells accounted for 42.5% of variations in walking by itself and substantially different distributions by purposes, a walking variable with a 3-point ordinal scale was created coded as: 1) no walking (neither transportation nor recreational walking), 2) low walking (walking for 1-149 minutes for either purpose), and 3) high walking (walking for 150+ minutes for either purpose or 1-149 minutes for both purposes).

Table 35 The Three-by-three Table of Walking Minutes between Transportation and Recreation Purposes

Walking minutes for recreation per week	Walking minutes for transportation per week			Total
	150+ min.	1-149 min.	0 min.	
150+ min.	1[c] (0.3%)	10[c] (3.4%)	68[c] (23.3%)	79 (27.1%)
1-149 min.	0[c] (0.0%)	28[c] (9.6%)	124[b] (42.5%)	152 (52.1%)
0 min.	1[c] (0.3%)	8[b] (2.7%)	52[a] (17.8%)	61 (20.9%)
Total	2 (0.7%)	46 (15.8%)	244 (83.6%)	292 (100.0%)

[a] coded as “1” no walking: neither transportation nor recreational walking, [b] as “2” low walking: walking for 1-149 minutes for either purpose, and [c] as “3” high walking: walking for 150+ minutes for either purpose or 1-149 minutes for both purposes.

Based on findings from the existing literature, overall perceptions of neighborhood safety were conceptualized with a compound of perceived safety from traffic, perceived safety from crime, and perceived safety for walking (Alfonzo et al., 2008; Foster & Giles-Corti, 2008; Won, Lee, Forjuoh, & Ory, 2016). Perception of traffic-related safety included relevant survey items such as low traffic on streets, crosswalks, and signals on busy streets, and slow speeds. Perception of crime-related safety encompassed well-lit streets, many people walking and biking, and neighbors able to be counted on. For consistency with binary measures from the STW survey, the safety related items measured with a 4-point scale (from strongly disagree to strongly agree) from the NPQ survey were dichotomized into discrete variables indicating high vs. low perceptions. The items were summed ranging from 0 to 3 by three dimensions (i.e. traffic, crime, walking). And then, all items were summed up again to generate a composite measure capturing overall perceptions of neighborhood safety, thus ranging from 0 to 9.

5.4.2.2 Perceived Livability: Secondary Outcome Variable

Perceived livability was captured with two relevant survey items: 1) my neighborhood is a good place to live and 2) my neighborhood is as good place to raise children. The items were measured with a 4-point scale from strongly disagree to strongly agree. When considering the study populations who were 50 years or older, the first item was prioritized to capture the livability. On such an occasion where an observation missed the first item, the second item was utilized to replace the missing values. The percentage of missing values for the composite variable was only 0.7%. However, due to a tendency of residents generously rating their residential areas (Cummins, 2000), 70% of residents reported strongly agreeing with the livability of their neighborhoods. Only 4% of residents strongly disagreed or somewhat disagreed with the survey statement about neighborhood livability. Therefore, the composite variable was dichotomized to indicate strong agreement vs. somewhat agree or disagree. These items were measured from only one survey, the NPQ, thus perceived livability at a community level was examined only in four urban towns.

5.4.2.3 Personal and Household Characteristics

This study identified personal and household level characteristic variables based on the hypotheses of this study encompassing: 1) demographics, 2) SES, and 3) lifestyle-related characteristics interacting with walking and neighborhood considerations. The two surveys included questions about residential and household demographics, SES, and personal health status. Personal and household characteristics were captured with the survey items. The personal demographic dimension included age, gender, race/ethnicity, SES (e.g. educational attainment, employment), health conditions (BMIs), and lifestyle-related characteristics (e.g. marital status, working hours). The household characteristics dimension included household level SES (household income), residential attributes (length of residence and community settings), and lifestyle-related factors (the number of vehicles, the number of children in a household).

Community settings of residential locations were labeled by identifying the participants of the NPQ survey as the urban resident group and respondents to the STW survey as the rural resident group. Household incomes were measured by a 7-point scale: less than $25k (coded as 1), $25k-$34.9k (2), $35k-$49.9k (3), $50k-$74.9k (4), $75k-$99.9k (5), $100k-$149.9k (6), and $150k or more (7). Several personal and household trait variables showed skewed distributions or a small portion of one or two categories (less than 10%). Thus, BMIs were divided into those with obesity vs. non-obesity, educational levels were categorized into those who attained a college degree or higher vs. lower than a college graduate, and the number of children in a household which was measured with an open-ended question and dichotomized into the presence of a child vs. no child in the household.

5.4.2.4 Personal Attitude and Activity Variables

Neighborhood considerations were measured with four kinds of questions: 1) affordable housing, 2) attractiveness of the neighborhood, 3) ease of walking to retails and services or ease of walking to parks or recreation facilities, and 4) neighborhood safety. Respondents were asked to report on a binary scale and with multiple-choice their important reasons for choosing their residential locations. Of the four kinds of neighborhood consideration items, the variables related to neighborhood walkability and safety were used as the key variables in this study based on the conceptual model, as well as to determine the neighborhood discordances. Two other consideration factors were utilized as confounding or independent variables along with hypothesized relationships.

The personal activity dimension was related to disadvantages and social factors for walking, and physical or sedentary activities. This dimension included any difficulty in walking, physical activity level at work places, having someone to walk with, hours spent on screens, and walking for transportation and recreation. Walking difficulty was measured with a 5-point scale from “not at all difficult” to “do not walk at all”. This measure was categorized into a discrete variable indicating having a little difficulty, at least compared to “no difficulty”, as a reference (82% in urban towns and 91% in rural towns). Having someone to walk with was a social factor to capture social support being able to motivate walking behaviors. The levels of physical activity at work places were measured with a 4-point scale from "mostly sitting" to "mostly heavy labor or physically demanding work". Due to only 20% of respondents reporting performing their works mostly standing, walking, or with heavy labor, the observations were also divided into two groups: work involving standing, walking, or heavy labor vs. work involving mostly standing. In the case of jobless respondents, the observations were considered in the "mostly sitting" category. Sedentary activities were measured with self-reported hours per week and weekend day devoted to watching televisions and smartphones, or sitting at desks and in front of computers. The hours per week and weekend day were summed up to indicate hours per week spent on screens or sitting.

5.4.2.5 Objective Environmental Attributes

For this study, environmental attributes were identified based on the hypotheses of this study regarding relationships with neighborhood walking, safety, and livability. The attributes which were objectively measured included eight general dimensions: 1) density, 2) accessibility to destinations, 3) street connectivity, 4) safety related risks, 5) greenery, 6) transportation infrastructure, 7) pedestrian infrastructure, and 8) regional home location in both rural and urban towns. Among objective measures of built and social environments, which are described with more detail in the data collection processes in Chapter III, several variables were not included in the conceptual model and hypotheses of this study (e.g. pedestrian network completeness, generalized land uses). According to Saelens and Handy (2008), accessibility to neighborhood destinations was a built environment feature with sufficient evidence of association with walking. Mixed land uses were also a feature associated with walking, so that mixed land uses caused destinations to cluster. In addition, density was one of the more important predictors of walking. Thus, higher density areas and mixed land uses were closely related to more destinations being within close proximity (Saelens & Handy, 2008). Rather than some descriptions of generalized land uses, a combination of built environment features including land use mix, residential density, and street connectivity was more effective in describing supportive environmental conditions to encourage walking (Alfonzo et al., 2008; Sallis et al., 2009). According to Ewing and Cervero (2001), for walking trips, employment density around destinations are as important as population densities around origins, and it may be more important (Ewing & Cervero, 2001). Therefore, this study utilized neighborhood destinations, residential density, and employment density variables to capture such compact, mixed use developments.

The above-mentioned density dimension included both residential density and employment density. The accessibility dimension was a compound of the total number of all types of destinations (e.g. food stores, food services, park or recreational destinations). The street connectivity dimension was identical to the intersection density which was a calculation of the number of intersection with ≥3 legged divided by the total length of streets. The mean of NDVIs with a 1km buffer from a home location was used for the greenery dimension. The safety related risks encompassed the density (a yearly average of incidents per $1km^2$) of violent crime incidents, total crime incidents (e.g. property crime, behavioral crime), pedestrian or cyclist crashes, total crashes, and the density (the total number per $1km^2$) of sex offenders in neighborhoods. The transportation dimension was represented by the presence of highways or railroads due to a low percentage of railroad presences (7.3%). The pedestrian infrastructure dimension contained sidewalk completeness and the number of crosswalks. The regional home locations were captured by kilometers from respondents' homes to city halls. Using GIS techniques, the attributes of built environments were objectively measured based on the home locations of respondents within a 1km circular and sausage network buffers which were an approximation of maximum distance reachable by walking to destinations at a community level (Algert et al., 2006; Witten et al., 2011).

5.4.2.6 Control Variables

Like Study 1, this study also involves a conceptualized relationship of the influence of neighborhood consideration when selecting residential locations on the current level of neighborhood walkability and safety. To reduce potential problems from the time differences, this study measured the percentage of parcels and areas involving new developments after the move-in dates within a 1km buffer from their home locations. The measures were utilized as proxy variables to explain variations in environmental changes. The length of residence was also tested adding to statistical analyses processes to explain the variations. Because of moderate correlations between the length of residence and other parcel-basis proxy measures (r=0.642 – 0.695), the variables were not added together into multivariate models.

5.4.3 Walkability and Safety Indices: Evaluations of Environments

5.4.3.1 Discrete Evaluation of Environment Features

Since decision making for walking mode choices was possibly achieved through a particular combination (e.g. a composite walkability index) of multiple discrete conditions of built environments rather than individual roles of discrete evaluation features (e.g. the presence of crosswalks) (Alfonzo et al., 2008), this study aimed to develop composite walkability and safety indices, evaluate the objective quality of neighborhoods, and identify concordance and discordance between considered attributes and objectively evaluated characteristics. However, previous studies which adopted a systematic approach to evaluating neighborhood walkability have mainly focused on comparing the level of walking between residents in inner cities and suburban communities in a metropolitan area (Frank et al., 2012; Sallis et al., 2009). For example, variations in retail floor area ratios (FAR) may not be much effective in explaining walkability in peri-urban developments and small town communities (Frank et al., 2010). Therefore, it was a prerequisite to explore and identify built and social environment features associated with walking and safety at neighborhood levels among the study populations. Because of consistency among environmental features and skewed distributions of several variables (e.g. number of crosswalks, the length of railroads), discrete evaluations of objectively measured environment features were conducted. Since objective data were collected from different local services (e.g. police departments), large variations (e.g. total crimes) were found in several measures. To adjust for variations in the measures, the built and social environment features were evaluated by items related based on three criteria: 1) citywide mean, 2) presence/absence, and 3) mean of the city (sample-basis) (Table 36). In cases of residential densities, the citywide densities were significantly lower than the mean of the data due to the intensity of developments in residential areas where the home buffers were captured, although the calculations of density were performed using the net density. On the contrary, the intensity of development enabled us to observe a similar happening for NDVIs. The citywide means of NDVIs were much higher than the means of data. Thus, the means of data (sample mean by city) by cities were utilized for the thresholds for both residential and employment density measures for consistency, and the NDVI variable. The evaluated results were applied to binary evaluation variables (equal to the mean or higher vs. lower) by item. Through this process, the discrete environment features were used as candidate variables to predict the aggregated walkability and safety at neighborhood levels.

Table 36 A List of Environment Variables for Discrete Evaluations

General dimension	Sub dimension	Measured item	Variables	Evaluation method
Density		Residential density	Density of total housing units	3) Sample mean by city
			Density of single family housing units	3) Sample mean by city
			Density of multi-family housing units	3) Sample mean by city
		Employment density	Density of large businesses with > 100 employees	3) Sample mean by city
			Density of parcels with ≥100 employees	3) Sample mean by city
			Density of employees in large (≥100) businesses	3) Sample mean by city
Accessibility to destinations		Destination land uses	The number of destinations	1) Citywide mean
Street connectivity		Streets	Intersection density	1) Citywide mean
Safety	Pedestrian / bicycle facilities	Transportation	The number of crosswalks	1) Citywide mean
			Pedestrian network completeness	1) Citywide mean
			Sidewalk completeness	1) Citywide mean
	Safety from traffic		The presence of railroad	2) Presence/absence
			The presence of highway	2) Presence/absence
			The absence of railroad/highway	2) Presence/absence
		Crash	Density of total crashes	1) Citywide mean
			Density of pedestrian/cyclist crashes	1) Citywide mean
			Density of vehicle crashes	1) Citywide mean
	Safety from crime	Crime	Density of total crimes	1) Citywide mean
			Density of violent crimes	1) Citywide mean
			Density of property crimes	1) Citywide mean
			Density of behavioral crimes	1) Citywide mean
			Density of sex offenders	1) Citywide mean
Greenery	Green/vacant spaces	NDIV	The mean of NDVIs	3) Sample mean by city

5.4.3.2 Calculations of Utilitarian Walkability and Neighborhood Safety Indices

The Utilitarian Walkability Index (UWI) involved two major facets concerning walking for transportation: a physical walking-oriented environment and walking-related neighborhood safety. The Physical Utilitarian Walkability Index (PUWI) for this study was composed of 1) density (residential density and employment density), 2) accessibility (neighborhood destinations), 3) connectivity (intersection density), and 4) pedestrian infrastructure availability (e.g. sidewalk completeness, crosswalk availability) (Frank et al., 2010; Saelens, Sallis, Black, et al., 2003). Residential density was measured with the ratio of residential unit numbers to the land areas involved in residential use per 1km buffer from the home locations of respondents. Employment density was calculated with the number of employees in large businesses (≥ 100 employees) and parcels with 100 employees to the gross land areas per 1km buffer from the home locations of respondents (Moudon et al., 2011). The values of these two measures were recoded as "1" referring to high density and "0" indicating low density by a split at the city-level means of data. Street network connectivity was measured with the ratio of the number of intersections to the total length of streets. Its values were divided into high intersection density vs. low intersection density based on the citywide means of street densities. Accessibility to destinations was the total number of destinations within a walkable distance (1km buffer). The numbers were categorized into high accessibility vs. low accessibility using the citywide mean splits. Pedestrian infrastructures included sidewalk completeness and the number of crosswalks. The ratio of the total length of sidewalks to the total length of streets and the counts of crosswalks within 1km buffers were dichotomized into high levels of pedestrian infrastructure vs. low levels.

The Neighborhood Safety Index (NSI) was a function of 1) traffic-related safety (yearly crash densities), 2) crime-related safety (yearly crime densities), 3) pedestrian infrastructures (e.g. coverage of sidewalks, crosswalk availability), and 4) green or vacant spaces (NDVIs) (Alfonzo et al., 2008; Foster & Giles-Corti, 2008). Yearly crash densities were measured with the number of crime incidents from accumulated histories (2008-13 for urban towns and 2006-12 for rural towns). The number of accumulated crime histories was calculated into a yearly average of incidents per km^2 to adjust for variations in sizes of sausage buffers. The averaged numbers were split into high risks vs. low risks at a threshold of citywide means. Yearly crime densities were also obtained from cumulative data (2006-14 for urban towns and 2006-12 for rural towns). Likewise, the number of crash incidents was translated into a yearly average of incidents per km^2, which was then dichotomized on the basis of citywide means. The same discrete measures of sidewalks and crosswalks with PUWI were captured for NSI. Green or vacant spaces captured by NDVIs were adjusted by multiplying by 100 due to their small values with several decimal degrees. A discrete measure indicated high greenery vs. low greenery.

After establishing base structures for PUWI and NSI, multivariate mixed effect models were separately estimated to predict utilitarian walking and perceived safety and to find an optimal combination of environmental predictors. The standardized coefficients of mixed effect models were utilized for a weighting value of each discrete variable. To establish universal standards, the modeling was performed with the total samples, and mixed effect models were adopted to adjust for urban vs. rural variations in some factors (e.g. crosswalks), controlling for the clustering effects of towns and community types. After identifying and controlling for socio-demographic covariates (e.g. gender, age, income), one of the discrete built and social environment factors was added into the base models one at a time to predict walking and perceived safety. The processes were applied to all candidate environmental variables listed in Table 36, and the coefficients of factors which were theoretically important and conceptualized by this study framework are summarized in Table 37. The presence of highways or railroads included in the traffic risk dimension was excluded from the NSI because of a reverse direction of the relationship with perceived safety that should theoretically be negative.

Table 37 Weighting Values Derived from Partially Adjusted Mixed Effect Models

Domains and variables		Beta weighting values (from partially adjusted mixed effect models)	
		Physical walkability	Safety-related
Density	Density of total housing units	β 0.028, p=0.783	
	Density of employees in large (>100) businesses	β 0.213, p=0.047	
Accessibility	The number of destinations	β 0.213, p=0.047	
Connectivity	Intersection density (1: high-density; 0: low-density)	β 0.166, p=0.127	
	Intersection density (1: low-density; 0: high-density)		β 0.051, p=0.220
Pedestrian infrastructures	The number of crosswalks	β 0.129, p=0.274	
	Sidewalk completeness	β 0.080, p=0.433	β 0.026, p=0.525
Safety	Density of total crashes		
	Density of pedestrian/cyclist crashes (1: low-crash; 0: high-crash)		β 0.043, p=0.287
	Density of violent crimes		β 0.039, p=0.366
	Density of sex offenders		
Greenery	The mean of NDVIs (1: low-NDVI; 0: high-NDVI)		β 0.103, p=0.009

Note that the density of total crashes and sex offenders were excluded from the beta weighting indices due to counter-intuitiveness.

In sequence, the PUWI and NSI were produced with functions of identified environment predictors, as formulated by the following expressions:

Physical Utilitarian Walkability Index (PUWI): 1) Density (residential units and employees) + 2) Accessibility (destinations) + 3) Connectivity (intersection density) + 4) Infrastructures (sidewalks and crosswalks)

$$PUW = 0.028 \times (residential\ density) + 0.213 \times (employment\ density) + 0.213 \times (the\ total\ number\ of\ destinations) + 0.166 \times (intersection\ density) + 0.129 \times (the\ number\ of\ crosswalks) + 0.080 \times (sidewalk\ completeness)$$

Neighborhood Safety Index (NSI): 1) Traffic-related safety (total crash density and intersection density), 2) Crime-related safety (violent crime density), 3) Pedestrian infrastructures (sidewalk completeness), and 4) Green/vacant spaces (NDVIs)

$$NS = 0.043 \times (density\ of\ pedestrian/cyclist\ crashes)^{*} + 0.051 \times (intersection\ density)^{*} + 0.039 \times (density\ of\ violent\ crime)^{*} + 0.026 \times (sidewalk\ completeness) + 0.103 \times (the\ mean\ of\ NDVI)^{*}$$

* Lower values indicate higher safety

The index scores were calculated using weighting values from standardized coefficients of models predicting walking and perceived safety. However, the ranges of scores between walkability and safety indices are quite different (0 - 8.39 points for walkability; 0 – 2.43 points for safety) because of a different number of items (6 for PUWI and 5 for NSI). When creating a composite UWI combining the PUWI and NSI with continuous scales, z-scores of scores from the PUWI and NSI were taken by the city and then summed up. The sums were split by the means of cities again to evaluate neighborhood walkability minimizing potential problems due to different data sources. This method assumed an equivalent importance of a physical aspect and a safety aspect for neighborhood walkability (Doyle, Kelly-Schwartz, Schlossberg, & Stockard, 2006). Thus,

Utilitarian Walkability Index (UWI): [z-scores (PUWI) by cities] + [z-scores (NSI) by cities]

In addition, this study also attempted to develop a recreational walkability index with a function of accessibility to recreational destinations (e.g. fitness centers, parks, schools), street connectivity, pedestrian infrastructure, and greenery. However, in estimating recreation walking with the candidate predictors, many of the walking-friendly features were insignificantly and negatively associated with recreational walking (e.g. crosswalks, sidewalks, recreational destinations). This may be because recreational walking was mainly attributed to personal and social interaction variables (e.g. someone to walk with, age, employment status).

5.4.4 Neighborhood Discordance Calculation

The discrete composite index variables of neighborhood-level walkability and safety, the UWI and NSI, are then tabulated with neighborhood consideration variables (i.e. walkability consideration, safety consideration) as many of such studies were performed (Arvidsson et al., 2012; Ma & Dill, 2015; McGinn et al., 2007). Some of the previous studies evaluated neighborhood walkability or accessibility taking the highest quartile and lowest quartile or the highest tertile and lowest tertile of aggregated attributes (Gebel et al., 2011; Koohsari et al., 2015). Such methods were not appropriated for this study because a higher portion of the sample would be lost. This study matched neighborhood preference with the discrete environment evaluations split at the means of each city. Thus, the two-by-two tables identified neighborhood concordance and discordance between the expected and actual neighborhood walkability and safety, respectively. For further analyses, variables were coded to indicate the levels of concordance and discordance between neighborhood considerations and choices by four groups: (C) positive concordance (having a preference and living in walkable/safe communities), (P) preference concordance (having a preference but living in non-walkable/unsafe communities), (W)/(S) walkability or safety discordance (having no preference but living in walkable/safe communities), and (N) negative concordance (having no preference and living in non-walkable/unsafe communities) (Table 38).

Table 38 Definitions for Concordance and Discordance Groups

Group name (Initials)	Descriptions
Negative concordance (N)	Neither having a walkability (safety) preference nor living in walkable (safe) neighborhoods
Preference discordance (P)	Having no walkability (safety) preference but living in walkable (safe) neighborhoods
Walkability discordance (W) Safety discordance (S)	Having a walkability (safety) preference but living in non-walkable (unsafe) neighborhoods
Positive concordance (C)	Both having a walkability (safety) preference and living in walkable neighborhoods

5.4.5 Statistical Analyses

Before starting the statistical modeling process, preliminary tests were preceded with environmental factors objectively measured with two different spatial units: a 1km circular buffer and a 1km sausage network buffer from the home locations of respondents (Appendix B and C). But, the results showed that objectively measured crime and crash incidents within a sausage buffer were negatively associated with a higher perception of safety, while those within a circular buffer were positively correlated with safety perception. This may be because the non-network basis circular buffers were insufficient to capture perceptible extents of safety (Oliver et al., 2007). Thus, this study carried out statistical analyses with objectively measured data within a 1km sausage network buffer.

First, statistical analyses observed patterns and quality in the specific discrete environment features, the UWI and NSI, and discrete evaluations of neighborhood walkability and safety across the total sample and four subsamples, using descriptive analyses. It also tested differences in those specific features and composite attributes between subsamples (i.e. urban vs. rural, older adults vs. middle-aged adults), using bivariate analyses approaches: chi-square tests for all discrete environment factors (e.g.

high crime risks vs. low risks, high walkability vs. low) and independent samples t-tests for UWI and NSI with a continuous scale. Second, according to research aims and hypothesized relationships, this study examined associations between neighborhood consideration (considerations for walkability and safety) and neighborhood choices (the discrete walkability and safety). Using descriptive and bivariate analyses, the associations between neighborhood considerations and choices, and differences in the four-group concordance and discordance across the subsamples were examined. Because of consideration and choice measures with a binary scale, phi and Cramer's V tests were utilized to identify correlations between measures of the two main constructs. Patterns of the 4-goup concordances and discordances were compared between urban vs. rural and older adult and middle-aged adult subsamples, using chi-square tests and z-tests to compare column proportions among the four concordance and discordance groups in a post-hoc approach. The post-hoc tests were conducted with the Bonferroni correction method, which considered the number of hypotheses for the multiple hypotheses tests (Wilcox, 1996).

Third, this study identified personal or household predictors and environmental correlates of neighborhood discordance, which were identified by multiple comparisons using ANOVA (e.g. for household income, the number of vehicles) and chi-square (e.g. for gender, race) tests along with post-hoc analyses and Bonferroni's corrections, in order to understand the bivariate relationships between the predictors and neighborhood discordance. The predictors were found to designate the positive concordance group (C) as a reference group for all the multiple comparisons to observe the role of neighborhood discordance. Fourth, to test the hypothesized relationships between neighborhood discordance and utilitarian walking or perceived safety, multilevel modeling approaches were considered to account for the nested data structure at the town level and the community setting level, using multivariate mixed effect models. The estimated mixed effect models examined the influences of neighborhood discordance on utilitarian walking and perceived safety, and identified their predictors. In accordance with scales of outcome variables, binomial logistic (for utilitarian walking) and linear regression (for perceived safety) mixed effects models were estimated separately.

Fifth, based on the conceptual framework, multiple path models were structured with three kinds of endogenous outcome variables (i.e. walking behaviors, perceived safety, perceived livability) to examine various direct and indirect pathways between neighborhood discordances and the three outcome variables, using generalized structural equation modeling (GSEM) techniques. The GEM techniques were adopted because of complex model structures which involved binomial, multinomial, ordinal, and Gaussian outcomes or mediator variables, and multi-level structures (Acock, 2013; StataCorp, 2015). The structured models were developed along with each outcome variable and subsample respectively. This study specified main explanatory variables with objectively evaluated neighborhood walkability and safety indices (neighborhood choices), neighborhood considerations, and neighborhood discordances. The models also included individual or household characteristics to identify multivariate influences of those factors on neighborhood discordance and outcome variables, and to be utilized as control variables in irrelevant hypotheses tests. For the estimations, the maximum likelihood

(ML) estimation approach, widely assessed as an excellent method, was employed to develop the SEMs (Kline, 2005).

All descriptive, bivariate, and multivariate analyses were conducted with all the total sample, and urban, rural, older, and middle-aged subsamples. The statistical tests were performed at a 0.05 significance level using the Stata/IC 14 software package (StataCorp, College Station, TX), and the desired alpha level was adjusted for the multiple comparisons to 0.0083 (0.05/6) by the Bonferroni correction.

5.5 RESULTS

5.5.1 Bivariate Analyses

5.5.1.1 Objective Evaluations of Neighborhood Environments

The quality of neighborhoods was evaluated by features related to walkability and safety based on three criteria: 1) citywide mean, 2) presence/absence, and 3) mean of the city (sample-basis). The evaluated results with a binary scale were shown by the samples (Table 39). In the total sample, the highest percentage (60.8%) of residents lived in neighborhoods with intersection density higher than or equal to citywide means, followed by the density of sex offenders (59.8%) and density of total crashes (54.1%). Only 7.3% of residents lived in neighborhoods where there was a railroad. Comparing urban and rural resident samples, urban residents lived in neighborhoods with more crosswalks (χ^2= 91.837, p<0.001), railroads (χ^2= 19.902, p<0.001), railroads or highways (χ^2= 10.103, p<0.001), violent crimes (χ^2= 62.583, p<0.001), total crashes (χ^2= 13.430, p<0.001), and housing units (χ^2= 5.639, p=0.018) than rural residents. Rural residents had more intersections (χ^2= 15.072, p<0.001) and sidewalks (χ^2= 48.710, p<0.001) than urban residents in their neighborhoods. When considering older adult and middle-aged samples, middle-aged adults had more crosswalks (χ^2= 4.408, p=0.036), railroads (χ^2= 4.355, p=0.037), violent crimes (χ^2= 7.698, p=0.006), and sex offenders (χ^2= 4.599, p=0.032) than older adults in neighborhoods (Table 39).

Table 39 Neighborhood Environmental Characteristics: Descriptive Statistics

Domains and variables	Total	Urban	Rural	Older	Middle-aged
Regional locations					
Network distance to CBDs: mean of city or higher	303 (48.1%)	139 (47.3%)	164 (48.8%)	182 (49.7%)	121 (45.8%)
Infrastructures					
The number of crosswalks: citywide mean or more	315 (50.0%)	207*** (70.4%)	108 (32.1%)	170 (46.4%)	145* (54.9%)
Intersection density: citywide mean or higher	383 (60.8%)	155 (52.7%)	228*** (67.9%)	232 (63.4%)	151 (57.2%)
Sidewalk completeness: citywide mean or higher	140 (22.2%)	29 (9.9%)	111*** (33.0%)	77 (21.0%)	63 (23.9%)
Presence of railroad	46 (7.3%)	36*** (12.2%)	10 (3.0%)	20 (5.5%)	26* (9.8%)
Presence of highway	132 (21.0%)	68 (23.1%)	64 (19.0%)	77 (21.0%)	55 (20.8%)
Presence of railroad or highway	166 (26.3%)	95*** (32.3%)	71 (21.1%)	91 (24.9%)	75 (28.4%)
Greenery					
The mean of NDVIs: mean of city or higher	285 (45.2%)	133 (45.2%)	152 (45.2%)	176 (48.1%)	109 (41.3%)
Crime and crash					
Density of violent crimes: citywide mean or higher	272 (43.2%)	176*** (59.9%)	96 (28.6%)	141 (38.5%)	131** (49.6%)
Density of sex offenders: citywide mean or higher	377 (59.8%)	178 (60.5%)	199 (59.2%)	206 (56.3%)	171* (64.8%)
Density of total crashes: citywide mean or higher	341 (54.1%)	182*** (61.9%)	159 (47.3%)	193 (52.7%)	148 (56.1%)
Destinations					
Total number of destinations: citywide mean or more	323 (51.3%)	152 (51.7%)	171 (50.9%)	181 (49.5%)	142 (53.8%)
Density					
Density of housing units: mean of city or higher	311 (49.4%)	160* (54.4%)	151 (44.9%)	174 (47.5%)	137 (51.9%)
Density of parcels with >100 employees: mean of city or higher	256 (40.6%)	114 (38.8%)	142 (42.3%)	141 (38.5%)	115 (43.6%)
Density of employees in large (>100) businesses: mean of city or higher	156 (24.8%)	78 (26.5%)	78 (23.2%)	96 (26.2%)	60 (22.7%)

*** Greater than the counterpart (urban vs. rural; older vs. middle-aged) at 0.001; ** at 0.01; and * at 0.05.

The mean value of the utilitarian walkability index (UWI) was 4.84 ranging from 0.51 to 9.97, and the mean value of the neighborhood safety index (NSI) was 1.25 ranging from 0 to 2.62 among the total sample. The means of the UWI were not different between urban residents (mean 4.83) and rural residents (mean 4.84) ($t=0.065$, $p=0.948$), while the mean of the NWI among rural residents (mean 1.33) was significantly higher ($t=4.068$, $p<0.001$) than the mean among urban residents (mean 1.15). There was no difference of UWI ($t=0.498$, $p=0.619$) between older adults (mean 4.79) and middle-aged adults (mean 4.90). No differences of NSI ($t=0.987$, $p=0.324$) between older adults (mean 1.23) and middle-aged adults (mean 1.27) were also found (Table 40).

Values of both the UWI and NSI were categorized into a binary evaluation, walkability vs. non-walkability and safety vs. non-safety, based on the mean values by study cities. In the total sample, 52.1% of residents lived in walkable neighborhoods, while 47.9% lived in non-walkable neighborhoods. And, 53.7% of residents lived in safe neighborhoods, while 46.3% lived in unsafe neighborhoods. Comparing the urban and rural towns, more urban residents (61.2%) lived in safe neighborhood environments ($\chi^2=12.715$, $p<0.001$) compared to rural residents (47.0%). There were no significant differences in the number of residents living in walkable neighborhoods between the urban and rural subsamples, and in the number of adults living in either walkable or safe neighborhoods between the older and middle-aged adult subsamples (Table 41).

Table 40 Mean Values of Walkability and Safety Indices: Descriptive Statistics

Indices	Mean ± SD				
	Total	Urban	Rural	Older	Middle-aged
Physical utilitarian walkability index (PUWI)	3.59 ±2.654	3.68 ±2.411	3.51 ±2.850	3.56 ±2.666	3.62 ±2.642
Neighborhood safety index (NSI)	1.25 ±0.576	1.15 ±0.651	1.33*** ±0.487	1.23 ±0.573	1.27 ±0.581
Utilitarian walkability index (UWI): PUWI + NSI	4.84 ±2.611	4.83 ±2.287	4.84 ±2.867	4.79 ±2.621	4.90 ±2.600

*** Greater than the counterpart (urban vs. rural; older vs. middle-aged) at 0.001; ** at 0.01; and * at 0.05.

Table 41 Systematically Evaluated Neighborhood Walkability and Safety: Descriptive Statistics of Results

Walkability or safety	N (%)				
	Total	Urban	Rural	Older	Middle-aged
Walkable neighborhood	328 (52.1%)	150 (51.0%)	178 (53.0%)	185 (50.5%)	143 (54.2%)
Non-walkable neighborhood	302 (47.9%)	144 (49.0%)	158 (47.0%)	181 (49.5%)	121 (45.8%)
Safe neighborhood	338 (53.7%)	180*** (61.2%)	158 (47.0%)	198 (54.1%)	140 (53.0%)
Unsafe neighborhood	292 (46.3%)	114 (38.8%)	178*** (53.0%)	168 (45.9%)	124 (47.0%)
Both walkability and safety	254 (40.3%)	139 (47.3%)	115 (34.2%)	145 (39.6%)	109 (41.3%)
Out of residents with walkability (N=328)	(77.4%)	(92.7%)	(64.6%)	(78.4%)	(76.2%)
Out of residents with safety (N=338)	(75.1%)	(77.2%)	(72.8%)	(73.2%)	(77.9%)

*** Greater than the counterpart (urban vs. rural; older vs. middle-aged) at 0.001; ** at 0.01; and * at 0.05.

5.5.1.2 Neighborhood Concordance and Discordance: Relationships between Neighborhood Considerations and Neighborhood Choices

When relationships between walkability considerations and walkability choices captured by indices evaluating objective environmental conditions were examined, low (r_φ= 0.126, p=0.002) but significant correlations were found in the total sample. However, safety consideration and the objective evaluation of neighborhood safety were not significantly correlated (r_φ= 0.006, p=0.874) in either the urban or rural sample. Walkability consideration and quality of walkability were significantly correlated in urban (r_φ= 0.152, p=0.009) and older (r_φ= 0.143, p=0.006) subsamples. In the rural and middle-aged subsamples, no significant correlation between walkability considerations and walkability choices was found at a 0.05 level.

Regarding matching neighborhood considerations and neighborhood choices, out of 113 proponents of neighborhood walkability, 74 proponents lived in objectively evaluated walkable neighborhoods (positive concordance). The other 39 proponents lived in non-walkable neighborhoods (walkability discordance), and 254 non-proponents of neighborhood walkability resided in walkable neighborhoods (preference discordance) which were objectively evaluated. Of 513 proponents of neighborhood safety, 276 lived in objectively evaluated safe neighborhoods (positive concordance). The other 237 proponents lived in unsafe neighborhoods (preference discordance), and 62 non-proponents of neighborhood safety resided in safe neighborhoods (safety discordance). The results showed that some residents lived in neighborhoods that did not match their preference for neighborhood walkability (47% out of the total) and safety (48%) (Table 42).

Table 42 Descriptive Statistics of Concordance and Discordance Groups by the Samples

Domains and groups	N (%)				
	Total	Urban	Rural	Older	Middle-aged
Walkability					
(N) Negative concordance	263 (41.7%)	130 (44.2%)	133 (39.6%)	161 (44.0%)	102 (38.6%)
(P) Preference discordance	254 (40.3%)	119 (40.5%)	135 (40.2%)	145 (39.6%)	109 (41.3%)
(W) Walkability discordance	39 (6.2%)	14 (4.8%)	25 (7.4%)	20 (5.5%)	19 (7.2%)
(C) Positive concordance	74 (11.7%)	31 (10.5%)	43 (12.8%)	40 (10.9%)	34 (12.9%)
Walkability consideration (W+C)	113 (17.9%)	45 (15.3%)	68 (20.2%)	60 (16.4%)	53 (20.1%)
Safety					
(N) Negative concordance	55 (8.7%)	39 (13.3%)*	16 (4.8%)	36 (9.8%)	19 (7.2%)
(P) Preference discordance	62 (9.8%)	52 (17.7%)*	10 (3.0%)	39 (10.7%)	23 (8.7%)
(S) Safety discordance	237 (37.6%)	75 (25.5%)	162 (48.2%)*	132 (36.1%)	105 (39.8%)
(C) Positive concordance	276 (43.8%)	128 (43.5%)	148 (44.0%)	159 (43.4%)	117 (44.3%)
Safety consideration (S+C)	513 (81.4%)	203 (69.0%)	310 (92.3%)	291 (79.5%)	222 (84.1%)

*** Greater than the counterpart (urban vs. rural; older vs. middle-aged) at 0.001; ** at 0.01; and * at 0.05.
(N) Negative concordance: having no preference and living in non-walkable/unsafe neighborhoods.
(P) Preference discordance: having no preference but living in walkable/safe neighborhoods.
(W)/(S) Environment discordance: having a preference but living in non-walkable/unsafe neighborhoods.
(C) Positive concordance: having a preference and living in walkable/safe neighborhoods.

5.5.1.3 Correlates of Neighborhood Discordance

Out of the 630 total respondents, 277 (44.0%) were male, 366 (58.1%) were older adults (with a mean age of 67.4), 49 (7.8%) were Hispanic and 539 (85.7%) were non-Hispanic White, 143 (23.4%) were obese (BMI≥30), and 521 (83.0%) had an educational attainment of a college degree or higher. In their households, 49 (7.8%) respondents lived with a child, 376 (63.5%) earned an annual income of $50K or more, and the mean number of vehicles per person was 1.20. For factors related to personal attitudes and activities, 113 (17.9%) residents considered neighborhood walkability when they chose their residential location. Neighborhood safety was considered by 513 residents (81.4%) for their residential selection. Per week, 254 residents (40.4%) walked for utilitarian purposes at least 1 minute per week and 236 residents (37.5%) walked for recreation purposes for 150 minutes or more (Table 43 and Table 46). Additional details of the characteristics of subsample respondents were described in Chapter IV.

1) Personal/household Predictors of Discordances: Walkability

Out of the total sample, variations were found in Hispanics (χ^2=16.260, p=0.001), non-Hispanic Whites (χ^2=17.553, p=0.001), education attainments (χ^2=13.788, p=0.003), walking for transportation (χ^2=18.287, p<0.001), and distances to CBDs (χ^2=66.207, p<0.001) among the four concordance and discordance groups, from the ANOVA and chi-square test results. No differences were found in the other personal and household factors such as the rates of male residents, the mean age of residents, and annual household incomes. Multiple group comparisons through post-hoc analyses showed the preference discordance (6.7%) and negative concordance (5.0%) groups of residents had a lower tendency to be Hispanic than the positive concordance group (16.2%). Non-Hispanic White residents were more likely to belong to the preference discordance (87.8%) and negative concordance (88.9%) groups than the positive concordance group (71.6%). Residents who had education attainments lower than a college graduate (38.5%) were more prone to live with walkability discordance than positive concordance (17.6%). Residents who walked for transportation at least 1 minute per week were less likely to belong to the preference discordance (39.5%) and negative concordance (34.7%) groups. Living at a distance from CBDs led toward belonging to the preference discordance (40.6%), walkability discordance (51.3%), and negative concordance (64.3%) groups, compared to the positive concordance group (14.9%) (Table 43).

Table 43 Personal/Household Predictors of Discordances Regarding Walkability in the Total Sample: Descriptive Statistics and Multiple Comparison Results

Domains and variables	Groups; N (%) or Mean ± SD				
	(N)	(P)	(W)	(C)[a]	Total
Personal – demographics					
Gender: Male (ref= female)	120 (45.6%)	108 (42.5%)	15 (38.5%)	34 (45.9%)	277 (44.0%)
Age: ranging 50 – 92 years	67.09 ±8.602	67.98 ±10.523	67.92 ±11.184	66.11 ±9.085	67.39 ±9.638
65 years or older (ref= < 65)	161 (61.2%)	145 (57.1%)	20 (51.3%)	40 (54.1%)	366 (58.1%)
70 years or older (ref= < 70)	94 (35.7%)	112 (44.1%)	15 (38.5%)	26 (35.1%)	247 (39.2%)
Hispanic, Latino or Spanish origin (ref= others)	13 (-) (5.0%)	17 (-) (6.7%)	7 (17.9%)	12 (16.2%)	49 (7.8%)
Race: non-Hispanic, White (ref= others)	233 (+) (88.9%)	223 (+) (87.8%)	30 (76.9%)	53 (71.6%)	539 (85.7%)
Obese: BMI>=30 (ref= non-obese (BMI<30))	62 (24.4%)	60 (24.2%)	7 (18.9%)	14 (19.4%)	143 (23.4%)
Marital status: Married (ref= unmarried)	202 (77.4%)	169 (66.8%)	28 (71.8%)	52 (71.2%)	451 (72.0%)
Education level: some college or higher (ref= lower than some college)	222 (85.1%)	214 (84.3%)	24 (-) (61.5%)	61 (82.4%)	521 (83.0%)
Employment Status: for wages/self-employed (ref= unemployed)	128 (49.2%)	124 (48.8%)	20 (51.3%)	40 (54.1%)	312 (49.8%)
Working hours per week	16.17 ±20.906	15.92 ±20.872	16.30 ±19.565	18.25 ±21.088	16.32 ±20.797
Personal – attitudes and activities					
Housing affordability consideration	169 (64.3%)	153 (-) (60.2%)	24 (61.5%)	57 (77.0%)	403 (64.0%)
Attractiveness consideration	236 (89.7%)	214 (84.3%)	34 (87.2%)	64 (86.5%)	548 (87.0%)
Safety consideration	208 (79.1%)	205 (80.7%)	35 (89.7%)	65 (87.8%)	513 (81.4%)
Any difficulty in walking (ref= no difficulty)	28 (10.6%)	42 (16.5%)	3 (7.7%)	9 (12.2%)	82 (13.0%)
Someone to walk with (ref= no one)	180 (68.7%)	162 (63.8%)	27 (69.2%)	49 (66.2%)	418 (66.5%)
PA at work: standing/walking/heavy labor (ref= not work/sitting)	48 (18.4%)	49 (19.4%)	12 (30.8%)	19 (26.0%)	128 (20.4%)
Screen/sitting hours per week	16.08 ±12.601	17.08 ±11.974	16.29 ±15.464	14.96 ±12.255	16.36 ±12.494
Walking for all purposes per week: 150+ min. (ref: 0-149 min.)	105 (40.2%)	104 (40.9%)	20 (51.3%)	35 (47.3%)	264 (42.0%)
Walking for transportation per week: 1+ min. (ref: 0 min.)	91 (-) (34.7%)	100 (-) (39.5%)	17 (43.6%)	46 (62.2%)	254 (40.4%)
Walking for recreation per week: 150+ min. (ref: 0-149 min.)	98 (37.3%)	94 (37.0%)	19 (48.7%)	25 (33.8%)	236 (37.5%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.

Table 43 Continued

Domains and variables	Groups; N (%) or Mean ± SD				
	(N)	(P)	(W)	(C)[a]	Total
Household characteristics					
Length of residence	17.77 ±12.112	18.37 ±13.192	24.67 ±13.691	19.88 ±14.216	18.69 ±12.986
The number of vehicles per person	1.22 ±0.494	1.22 ±0.582	1.00 ±0.429	1.18 ±0.539	1.20 ±0.534
The number of children in household	0.10 ±0.422	0.14 ±0.534	0.13 ±0.469	0.16 ±0.642	0.12 ±0.501
The presence of children in household	17 (6.5%)	23 (9.1%)	3 (7.7%)	6 (8.1%)	49 (7.8%)
Annual household income[b]	4.17 ±1.703	4.00 ±1.659	3.71 ±1.934	3.70 ±1.705	4.02 ±1.703
Annual household income (≥$50k)	166 (66.7%)	153 (64.3%)	18 (51.4%)	39 (55.7%)	376 (63.5%)
Regional locations					
Network distance to CBDs[c]	169 (+) (64.3%)	103 (+) (40.6%)	20 (+) (51.3%)	11 (14.9%)	303 (48.1%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.
[b] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" ≥$150k.
[c] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

Among the urban subsample, the differences among concordance or discordance groups were found in marriage (χ^2=10.187, p=0.017), walking for recreation (χ^2=8.679, p=0.034), household incomes ≥$50K ($\chi^2$=9.963, p=0.019), and distances from CBDs (χ^2=37.765, p<0.001). Post-hoc analyses demonstrated that those who walked for recreation and lived at a distance from CBDs were more likely to belong to the walkability discordance groups. A longer distance from CBDs was also a correlate of negative concordance. No other variations were found between discordances/negative concordance and positive concordance (Table 44). In the rural subsample, the rates of Hispanic (χ^2=18.743, p<0.001), White (χ^2=14.763, p=0.002), educated residents (χ^2=14.071, p=0.003), walking for transportation (χ^2=19.294, p<0.001), and detachment from downtowns (χ^2=30.302, p<0.001) were different from each other among groups.

Compared to the positive concordance group, the preference discordance group had a tendency to have more Whites, was less likely to walk for transportation, and had a higher detachment of home locations. The walkability discordance group was related to a lower level of utilitarian walking and a longer distance from downtowns. More Whites, fewer Hispanics, utilitarian walkers, and the detachment of homes were predictors of negative concordance (Table 44).

Table 44 Personal/Household Predictors of Discordances Regarding Walkability in the Urban and Rural Subsamples: A Summary Table of Multiple Comparison Results

Domains and variables	Groups; N (%) or Mean ± SD					
	Urban			Rural		
	(N)	(P)	(W)	(N)	(P)	(W)
Personal – demographics						
Gender: Male (ref= female)						
Age: ranging 50 – 92 years						
Hispanic, Latino or Spanish origin (ref= others)				-		
Race: non-Hispanic, White (ref= others)				+	+	
Obese: BMI>=30 (ref= non-obese (BMI<30))						
Marital status: Married (ref= unmarried)						
Education level: some college or higher (ref= lower than some college)						
Employment Status: for wages/self-employed (ref= unemployed)						
Working hours per week						
Personal – attitudes and activities						
Housing affordability consideration						
Attractiveness consideration						
Safety consideration						
Any difficulty in walking (ref= no difficulty)						
Someone to walk with (ref= no one)						
PA at work: standing/walking/heavy labor (ref= not work/sitting)						
Screen/sitting hours per week						
Walking for transportation per week: 1+ min. (ref: 0 min.)				-	-	-
Walking for recreation per week: 150+ min. (ref: 0-149 min.)			+			
Household characteristics						
Length of residence						
The number of vehicles per person						
The presence of children in household						
Annual household income[a]						
Regional locations						
Network distance to CBDs[b]	+		+	+	+	+

Note that compared to (C) the positive concordance group (a reference group), (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.

[a] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" ≥$150k.

[b] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

In the older adult subsample, many differences among the concordance and discordance groups were found encompassing age ($F=7.438$, $p<0.001$), race ($\chi^2=15.591$, $p=0.001$) or ethnicity ($\chi^2=9.394$, $p=0.024$), obesity ($\chi^2=11.458$, $p=0.009$), utilitarian walking ($\chi^2=10.307$, $p=0.016$), education levels ($\chi^2=14.528$, $p=0.002$), children in the household ($F=2.659$, $p=0.048$), and the number of vehicles ($F=2.710$, $p=0.045$). Among those variables with variations, Hispanic (-) and White (+) residents were only predictors of preference discordance, while educated residents (-) were only a predictor of walkability discordance. Predictors of negative concordance were Hispanic (-), obese (+) residents, walking for transportation (-), and the distance to downtowns (+) (Table 45). Out of the middle-aged subsample, significant differences among groups included differences in race ($\chi^2=7.876$, $p=0.049$), ethnicity ($\chi^2=10.685$, $p=0.014$), education ($\chi^2=12.803$, $p=0.005$), housing affordability consideration ($\chi^2=8.299$, $p=0.040$), utilitarian walking ($\chi^2=8.026$, $p=0.045$), and household incomes ($F=3.043$, $p=0.029$). Post-hoc tests identified only detached homes (+) as a predictor of both preference and walkability discordances, while White (+), educated residents (+), utilitarian walking (-), and detached residences (+) as predictors of negative concordance (Table 45).

Table 45 Personal/Household Predictors of Discordances Regarding Walkability in the Older and Middle-aged Subsamples: A Summary Table of Multiple Comparison Results

Domains and variables	Groups; N (%) or Mean ± SD					
	Older			Middle-aged		
	(N)	(P)	(W)	(N)	(P)	(W)
Personal – demographics						
Gender: Male (ref= female)						
Age: ranging 50 – 92 years						
Hispanic, Latino or Spanish origin (ref= others)	-	-				
Race: non-Hispanic, White (ref= others)		+		+		
Obese: BMI>=30 (ref= non-obese (BMI<30))	+					
Marital status: Married (ref= unmarried)						
Education level: some college or higher (ref= lower than some college)			-	+		
Employment Status: for wages/self-employed (ref= unemployed)						
Working hours per week						
Personal – attitudes and activities						
Housing affordability consideration						
Attractiveness consideration						
Safety consideration						
Any difficulty in walking (ref= no difficulty)						
Someone to walk with (ref= no one)						
PA at work: standing/walking/heavy labor (ref= not work/sitting)						
Screen/sitting hours per week						
Walking for transportation per week: 1+ min. (ref: 0 min.)	-			-		
Walking for recreation per week: 150+ min. (ref: 0-149 min.)						
Household characteristics						
Length of residence						
The number of vehicles per person						
The presence of children in household						
Annual household income[a]						
Regional locations						
Network distance to CBDs[b]	+			+	+	+

Note that compared to (C) the positive concordance group (a reference group), (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.

[a] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" ≥$150k.

[b] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

2) Personal/Household Predictors of Discordances: Safety

In the total sample, variations were found among the four concordance and discordance groups, in Hispanics (χ^2=14.001, p=0.003), housing affordability consideration (χ^2=8.262, p=0.041), attractiveness consideration (χ^2=106.689, p<0.001), walking difficulty (χ^2= 18.547, p<0.001), someone to walk with (χ^2=13.165, p=0.004), utilitarian walking (χ^2=29.774, p<0.001), and recreational walking (χ^2=9.253, p=0.026). Multiple group comparisons showed that the preference discordance group (19.7%) had a higher tendency to be Hispanic than the positive concordance group (5.8%). The preference discordance (50.0%) and negative concordance (70.9%) groups were inclined to have a lower consideration of attractiveness compared to the positive concordance group (91.3%). Residents who had any difficulty in walking were more likely to have preference discordance (29.0% vs. 13.0%), compared to the positive concordance group. The results also found that preference discordance was related to lower levels of utilitarian walking (14.5% vs. 42.9%) and recreational walking (22.6% vs. 40.9%). The length of residence was longer in the preference (22.1 years) and safety (19.4 years) discordance and negative concordance (24.8 years) groups than in the positive concordance group (16.1 years). The rates of residents living in detached housing were higher in the positive concordance group (58.0%) than the preference (40.3%) and safety (41.4%) discordance groups and the negative concordance group (36.4%) (Table 46).

Table 46 Personal/Household Predictors of Discordances Regarding Safety in the Total Sample: Descriptive Statistics and Multiple Comparison Results

Domains and variables	Groups; N (%) or Mean ± SD				
	(N)	(P)	(S)	(C)[a]	Total
Personal socio-demographics					
Gender: Male (ref= female)	29 (52.7%)	30 (48.4%)	95 (40.1%)	123 (44.6%)	277 (44.0%)
Age: ranging 50 – 92 years	67.55 ±8.902	68.37 ±9.868	66.47 ±9.503	67.92 ±9.827	67.39 ±9.638
65 years or older (ref= < 65)	36 (65.5%)	39 (62.9%)	132 (55.7%)	159 (57.6%)	366 (58.1%)
70 years or older (ref= < 70)	20 (36.4%)	29 (46.8%)	82 (34.6%)	116 (42.0%)	247 (39.2%)
Hispanic, Latino or Spanish origin (ref= others)	5 (9.1%)	12 (+) (19.7%)	16 (6.8%)	16 (5.8%)	49 (7.8%)
Race: non-Hispanic, White (ref= others)	48 (87.3%)	47 (77.0%)	206 (86.9%)	238 (86.2%)	539 (85.7%)
Obese: BMI>=30 (ref= non-obese (BMI<30))	12 (23.1%)	19 (31.7%)	49 (21.3%)	63 (23.4%)	143 (23.4%)
Marital status: Married (ref= unmarried)	37 (67.3%)	40 (65.6%)	173 (73.6%)	201 (73.1%)	451 (72.0%)
Education level: some college or higher (ref= lower than some college)	44 (80.0%)	47 (77.0%)	193 (81.8%)	237 (85.9%)	521 (83.0%)
Employment Status: for wages/self-employed (ref= unemployed)	23 (41.8%)	29 (48.3%)	130 (55.1%)	130 (47.1%)	312 (49.8%)
Working hours per week	15.91 ±19.530	17.36 ±21.474	17.81 ±21.202	14.90 ±20.553	16.32 ±20.797
Personal activities/attitudes					
Housing affordability consideration	35 (63.6%)	31 (50.0%)	164 (69.2%)	173 (62.7%)	403 (64.0%)
Attractiveness consideration	39 (-) (70.9%)	31 (-) (50.0%)	226 (95.4%)	252 (91.3%)	548 (87.0%)
Walkability consideration	7 (12.7%)	6 (9.7%)	50 (21.1%)	50 (18.1%)	113 (17.9%)
Any difficulty in walking (ref= no difficulty)	8 (14.5%)	18 (+) (29.0%)	20 (8.4%)	36 (13.0%)	82 (13.0%)
Someone to walk with (ref= no one)	37 (67.3%)	29 (-) (46.8%)	168 (71.2%)	184 (66.7%)	418 (66.5%)
PA at work: standing/walking/heavy labor (ref= not work/sitting)	13 (24.1%)	10 (16.4%)	53 (22.4%)	52 (19.0%)	128 (20.4%)
Screen/sitting hours per week	14.56 ±11.341	16.44 ±14.938	17.31 ±14.013	15.89 ±10.602	16.36 ±12.494
Walking for all purposes per week: 150+ min. (ref: 0-149 min.)	19 (34.5%)	14 (-) (22.6%)	102 (43.2%)	129 (46.9%)	264 (42.0%)
Walking for transportation per week: 1+ min. (ref: 0 min.)	13 (24.1%)	9 (-) (14.5%)	114 (48.1%)	118 (42.9%)	254 (40.4%)
Walking for recreation per week: 150+ min. (ref: 0-149 min.)	16 (29.1%)	14 (-) (22.6%)	93 (39.2%)	113 (40.9%)	236 (37.5%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (S) safety discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.

Table 46 Continued

Domains and variables	Groups; N (%) or Mean ± SD				
	(N)	(P)	(S)	(C)[a]	Total
Household characteristics					
Length of residence	24.84 (+) ±15.055	22.10 (+) ±14.088	19.38 (+) ±12.259	16.08 ±12.280	18.69 ±12.986
The number of vehicles per person	1.24 ±0.489	1.21 ±0.512	1.17 ±0.516	1.22 ±0.564	1.20 ±0.534
The number of children	0.13 ±0.474	0.06 ±0.307	0.12 ±0.467	0.13 ±0.566	0.12 ±0.501
The presence of children in household	5 (9.1%)	3 (4.8%)	19 (8.0%)	22 (8.0%)	49 (7.8%)
Annual household income[b]	3.76 ±1.491	3.88 ±1.855	4.10 ±1.715	4.03 ±1.700	4.02 ±1.703
Annual household income (>=$50k)	30 (58.8%)	35 (60.3%)	146 (65.8%)	165 (63.2%)	376 (63.5%)
Regional locations					
Network distance to CBDs[c]	20 (-) (36.4%)	25 (-) (40.3%)	98 (-) (41.4%)	160 (58.0%)	303 (48.1%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (S) safety discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.
[b] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" ≥$150k.
[c] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

In the urban subsample, the group differences were found in Hispanic residents (χ^2=14.954, p=0.002), marriage (χ^2=9.835, p=0.020), attractiveness consideration (χ^2=58.185, p<0.001), and distances to CBDs (χ^2=9.639, p=0.022). Post-hoc tests demonstrated that Hispanic residents were more likely to belong to the preference discordance group, while those who had considered neighborhood attractiveness when selecting their residence were less likely to belong to the preference discordance group. No other variations were found between discordances/negative concordance and positive concordance among this urban subsample (Table 47). In the rural subsample, age (F=3.368, p=0.019), working hours (F=3.060, p=0.028), hours spent on screen (F=3.499, p=0.016), the rates of considering housing affordability (χ^2=17.490, p=0.001) and attractiveness (χ^2=56.025, p<0.001), and detached home locations (χ^2=42.952, p<0.001) were different from each other among the groups. The predictors of preference discordance were affordability (-) and attractiveness consideration (-), hours on screen (+), and the length of residence (+). Predictors of walkability discordance included age (-), working hours (+), the length of residence (+), and detached residential locations (-). Attractiveness consideration (-), the length of residence (+), and a detached home (-) were predictors of negative concordance (Table 47).

Table 47 Personal/Household Predictors of Discordances Regarding Safety in the Urban and Rural Subsamples: A Summary Table of Multiple Comparison Results

Domains and variables	Urban			Rural		
	(N)	(P)	(S)	(N)	(P)	(S)
Personal – demographics						
Gender: Male (ref= female)						
Age: ranging 50 – 92 years						-
Hispanic, Latino or Spanish origin (ref= others)		+				
Race: non-Hispanic, White (ref= others)						
Obese: BMI>=30 (ref= non-obese (BMI<30))						
Marital status: Married (ref= unmarried)						
Education level: some college or higher (ref= lower than some college)						
Employment Status: for wages/self-employed (ref= unemployed)						
Working hours per week						+
Personal – attitudes and activities						
Housing affordability consideration					-	
Attractiveness consideration		-		-	-	
Safety consideration						
Any difficulty in walking (ref= no difficulty)						
Someone to walk with (ref= no one)						
PA at work: standing/walking/heavy labor (ref= not work/sitting)						
Screen/sitting hours per week					+	
Walking for transportation per week: 1+ min. (ref: 0 min.)						
Walking for recreation per week: 150+ min. (ref: 0-149 min.)						
Household characteristics						
Length of residence				+	+	+
The number of vehicles per person						
The presence of children in household						
Annual household income[a]						
Regional locations						
Network distance to CBDs[b]				-		-

Note that compared to (C) the positive concordance group (a reference group), (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (S) safety discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.

[a] Measured with a 7-point scale: "1" <\$25k, "2" \$25k-\$34.9k, "3" \$35k-\$49.9k, "4" \$50k-\$74.9k, "5" \$75k-\$99.9k, "6" \$100k-\$149.9k, and "7" ≥\$150k.

[b] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

Among the older adult subsample, differences among the concordance and discordance groups encompassed differences in working hours ($F=3.538$, $p=0.015$), attractiveness consideration ($\chi^2=70.910$, $p<0.001$), walking difficulty ($\chi^2=21.115$, $p<0.001$), someone to walk with ($\chi^2=14.443$, $p=0.002$), utilitarian walking ($\chi^2=21.067$, $p<0.001$), recreational walking ($\chi^2=7.890$, $p=0.048$), detached home ($\chi^2=14.779$, $p=0.002$), and the number of vehicles ($F=3.761$, $p=0.011$). Among those variables, attractiveness consideration (-), difficulty in walking (+), someone to walk with (-), utilitarian walking (-), recreational walking (-), and length of residence (+) were predictors of preference discordance, while working hours (+), length of residence (+), and detached homes (-) were predictors of walkability discordance. Predictors of negative concordance included attractiveness consideration (-), the length of residence (+), and detached home locations (Table 48). Out of the middle-aged subsample, significant differences among groups were variations in Hispanic residents ($\chi^2=16.955$, $p=0.001$), housing affordability consideration ($\chi^2=37.244$, $p<0.001$), and utilitarian walking ($\chi^2=19.235$, $p<0.001$). Tests for multiple group comparisons identified Hispanic (+), White residents (-), and attractiveness consideration (-) as predictors of preference discordance, while no significant predictor of safety discordance was found. Walking for transportation was the only personal factor to predict negative concordance (Table 48).

Table 48 Personal/Household Predictors of Discordances Regarding Safety in the Older and Middle-aged Subsamples: A Summary Table of Multiple Comparison Results

Domains and variables	Older			Middle-aged		
	(N)	(P)	(S)	(N)	(P)	(S)
Personal – demographics						
Gender: Male (ref= female)						
Age: ranging 50 – 92 years						
Hispanic, Latino or Spanish origin (ref= others)					+	
Race: non-Hispanic, White (ref= others)					-	
Obese: BMI>=30 (ref= non-obese (BMI<30))						
Marital status: Married (ref= unmarried)						
Education level: some college or higher (ref= lower than some college)						
Employment Status: for wages/self-employed (ref= unemployed)						
Working hours per week			+			
Personal – attitudes and activities						
Housing affordability consideration						
Attractiveness consideration	-	-			-	
Safety consideration						
Any difficulty in walking (ref= no difficulty)		+				
Someone to walk with (ref= no one)		-				
PA at work: standing/walking/heavy labor (ref= not work/sitting)						
Screen/sitting hours per week						
Walking for transportation per week: 1+ min. (ref: 0 min.)		-		-		
Walking for recreation per week: 150+ min. (ref: 0-149 min.)		-				
Household characteristics						
Length of residence	+	+	+			
The number of vehicles per person						
The presence of children in household						
Annual household income[a]						
Regional locations						
Network distance to CBDs[b]	-		-			

Note that compared to (C) the positive concordance group (a reference group), (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (S) safety discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.

[a] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" ≥$150k.

[b] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

3) Environmental Correlates of Discordance: Walkability

Out of the total sample, the environmental variations among the four concordance and discordance groups were found in the perception of safety from traffic ($F=3.459$, $p=0.016$) and all objectively measured environmental factors across infrastructure, greenery, crime/crash, destination, and density dimensions, from the ANOVA and chi-square test results. Results from post-hoc tests demonstrated that environmental correlates of preference discordance included crosswalks (-), intersection density (-), sidewalks (-), sex offenders (-), pedestrian crashes (-), total crashes (-), neighborhood destinations (-), and employment density (-). Correlates of walkability discordance encompassed crosswalks (-), intersection density (-), sidewalks (-), NDVIs (+), pedestrian crashes (-), total crashes (-), destinations (-), housing density (-), and employment density (-). Crosswalks (-), intersection density (-), sidewalks (-), railroad/highway (-), violent crime (-), sex offenders (-), pedestrian crashes (-), total crashes (-), destinations (-), and employment density (-) were correlates of negative concordance. No significant perception correlates were found (Table 49).

Table 49 Environmental Correlates of Discordances Regarding Walkability in the Total Sample: Descriptive Statistics and Multiple Comparison Results

Domains and variables	Groups; N (%) or Mean ± SD			
	(N)	(P)	(W)	(C)[a]
Self-reported perceived safety				
Perceived safety related to traffic	1.79 ±0.861	1.93 ±0.812	2.15 ±0.875	2.04 ±0.943
Perceived safety related to crime	2.24 ±0.801	2.33 ±0.765	2.23 ±0.706	2.32 ±0.813
Perceived safety related to walking	2.16 ±0.813	2.21 ±0.795	1.90 ±0.912	2.07 ±0.833
Overall perceived safety	6.19 ±1.839	6.47 ±1.655	6.28 ±1.905	6.43 ±1.924
Objective measure - Infrastructures				
Number of crosswalks[b]	90 (-) (34.2%)	148 (-) (58.3%)	13 (-) (33.3%)	64 (86.5%)
Intersection density[b]	128 (-) (48.7%)	175 (-) (68.9%)	17 (-) (43.6%)	63 (85.1%)
Sidewalk completeness[b]	18 (-) (6.8%)	82 (-) (32.3%)	2 (-) (5.1%)	38 (51.4%)
Presence of railroad[c]	11 (4.2%)	22 (8.7%)	4 (10.3%)	9 (12.2%)
Presence of highway[c]	22 (-) (8.4%)	76 (29.9%)	7 (17.9%)	27 (36.5%)
Presence of railroad/highway[c]	31 (-) (11.8%)	92 (36.2%)	9 (23.1%)	34 (45.9%)
Objective measure – Greenery				
Mean of NDVIs[d]	244 (+) (92.8%)	7 (2.8%)	33 (+) (84.6%)	1 (1.4%)
Objective measure - Crime and crash				
Density of violent crime[b]	73 (-) (27.8%)	127 (50.0%)	23 (59.0%)	49 (66.2%)
Density of sex offenders[b]	142 (-) (54.0%)	153 (-) (60.2%)	25 (64.1%)	57 (77.0%)
Density of pedestrian/cyclist crashes[b]	96 (-) (36.5%)	152 (-) (59.8%)	21 (-) (53.8%)	65 (87.8%)
Density of total crashes[b]	87 (-) (33.1%)	169 (-) (66.5%)	19 (-) (48.7%)	66 (89.2%)
Objective measure - Destinations				
Number of destinations[b]	70 (-) (26.6%)	169 (-) (66.5%)	20 (-) (51.3%)	64 (86.5%)
Objective measure – Density				
Density of housing units[d]	108 (-) (41.1%)	143 (56.3%)	15 (-) (38.5%)	45 (60.8%)
Density of parcels with large businesses[d]	59 (-) (22.4%)	133 (-) (52.4%)	11 (-) (28.2%)	53 (71.6%)
Density of employees in large businesses[d]	11 (-) (4.2%)	97 (-) (38.2%)	2 (-) (5.1%)	46 (62.2%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) a positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.
[b] Objectively measured and categorized with binary scale: "1" citywide mean or higher values and "0" lower value.
[c] Objectively measured with binary scale: "1" presence and "0" absence.
[d] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

Among the urban subsample, the environmental variations among the concordance and discordance groups were found in the perception of safety for walking (F=2.926, p=0.034) and all objectively measured environmental factors except for intersection density, sidewalks, and housing density. Post-hoc analyses showed that no environmental correlates of preference discordance were found, while correlates of walkability discordance were NDVIs (+) and employment density (-). Crosswalks (-), railroad/highway (-), NDVIs (+), violent crime (-), pedestrian crashes (-), total crashes (-), destinations (-), and employment density (-) were correlates of negative concordance (Table 50). In the rural subsample, environmental differences among the concordance and discordance groups were found in the perception of safety from traffic (F=4.579, p=0.004) and all objectively measured environmental factors. Environmental correlates of preference discordance included crosswalks (-), sex offenders (-), pedestrian crashes (-), total crashes (-), neighborhood destinations (-), and employment density (-). Correlates of walkability discordance were crosswalks (-), intersection density (-), sidewalks (-), NDVIs (+), pedestrian crashes (-), total crashes (-), destinations (-), housing density (-), and employment density (-). Crosswalks (-), intersection density (-), sidewalks (-), railroad/highway (-), NDVIs (+), violent crime (-), pedestrian crashes (-), total crashes (-), destinations (-), and employment density (-) were correlates of negative concordance. No significant perception correlates of discordances were found in either urban or rural subsample (Table 50).

Table 50 Environmental Correlates of Discordances Regarding Walkability in the Urban and Rural Subsamples: A Summary Table of Multiple Comparison Results

Domains and variables	Urban			Rural		
	(N)	(P)	(W)	(N)	(P)	(W)
Self-reported perceived safety						
Perceived safety related to traffic						
Perceived safety related to crime						
Perceived safety related to walking						
Overall perceived safety						
Objective measure - Infrastructures						
Number of crosswalks[a]	-			-	-	-
Intersection density[a]				-		-
Sidewalk completeness[a]				-	-	-
Presence of railroad[b]				-		
Presence of highway[b]	-			-		
Presence of railroad/highway[b]	-			-		
Objective measure – Greenery						
The mean of NDVIs[c]	+		+	+		+
Objective measure - Crime and crash						
Density of violent crime[a]	-			-		
Density of sex offenders[a]					-	
Density of pedestrian/cyclist crashes[a]	-			-	-	-
Density of total crashes[a]	-			-	-	-
Objective measure - Destinations						
Total number of destinations[a]	-			-	-	-
Objective measure – Density						
Density of housing units[c]				-		-
Density of parcels with large businesses[c]	-		-	-	-	-
Density of employees in large businesses[c]	-		-	-	-	-

Note that compared to (C) the positive concordance group (a reference group), (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.

[a] Objectively measured and categorized with binary scale: "1" citywide mean or higher values and "0" lower value.

[b] Objectively measured with binary scale: "1" presence and "0" absence.

[c] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

In the older adult subsample, group differences were found in perceived safety from traffic (F=3.294, p=0.021) and all objective environmental variables except for sex offenders. Post-hoc tests found crosswalks correlated with preference discordance, while crosswalks (-), intersection density (-), sidewalks (-), NDVIs (+), total crashes (-) housing density (-), and employment density (-) were associated with walkability discordance. Crosswalks (-), intersection density (-), sidewalks (-), railroad/highway (-), NDVIs (+), violent crime (-), pedestrian crashes (-), total crashes (-), destinations (-), housing density (-), and employment density (-) were correlates of negative concordance (Table 51). Out of the middle-aged subsample, no significant differences were found in all safety perception variables and housing density which was objectively measured. All other objective environmental factors showed differences from each other among concordance and discordance groups. Crosswalks (-), pedestrian crashes (-), and total crashes (-) were environmental correlates of preference discordance, while crosswalks (-), sidewalks (-), NDVIs (+), pedestrian crashes (-), total crashes (-), destinations (-), and employment density (-) were correlates of walkability discordance. Crosswalks (-), intersection density (-), sidewalks (-), railroad/highway (-), NDVIs (+), violent crime (-), sex offenders (-), pedestrian crashes (-), total crashes (-), destinations (-), and employment density (-) were correlates of negative concordance. No significant perception correlates of discordances were found in either older or middle-aged subsamples (Table 51).

Table 51 Environmental Correlates of Discordances Regarding Walkability in the Older and Middle-aged Subsamples: A Summary Table of Multiple Comparison Results

Domains and variables	Older			Middle-aged		
	(N)	(P)	(W)	(N)	(P)	(W)
Self-reported perceived safety						
Perceived safety related to traffic						
Perceived safety related to crime						
Perceived safety related to walking						
Overall perceived safety						
Objective measure - Infrastructures						
Number of crosswalks[a]	-	-	-	-	-	-
Intersection density[a]	-		-	-		
Sidewalk completeness[a]	-		-	-		-
Presence of railroad[b]						
Presence of highway[b]	-			-		
Presence of railroad/highway[b]	-			-		
Objective measure – Greenery						
The mean of NDVIs[c]	+		+	+		+
Objective measure - Crime and crash						
Density of violent crime[a]	-			-		
Density of sex offenders[a]				-		
Density of pedestrian/cyclist crashes[a]	-			-	-	-
Density of total crashes[a]	-		-	-	-	-
Objective measure - Destinations						
Total number of destinations[a]	-			-		-
Objective measure – Density						
Density of housing units[c]	-		-			
Density of parcels with large businesses[c]	-		-	-		-
Density of employees in large businesses[c]	-		-	-	-	-

Note that compared to (C) the positive concordance group (a reference group), (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.

[a] Objectively measured and categorized with binary scale: "1" citywide mean or higher values and "0" lower value.

[b] Objectively measured with binary scale: "1" presence and "0" absence.

[c] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

4) Environmental Correlates of Discordance: Safety

In the total sample, environmental variations were found among the four concordance and discordance groups in perceived safety related to traffic ($F=4.225$, $p=0.006$), walking ($F=8.858$, $p<0.001$), and overall safety ($F=7.004$, $p<0.001$), and all objectively measured environmental factors except for sex offenders, destinations, and housing density. Multiple group comparisons showed that environmental correlates of preference discordance included crosswalks (+), railroad/highway (+), violent crimes (+), total crashes (+), and employment density (+). Correlates of safety discordance included intersection density (+), railroad/highway (+), NDVIs (+), violent crimes (+), and employment density (-). Intersection density (+), NDVIs (+), violent crime (+), pedestrian crashes (+), and employment density (-) were correlates of negative concordance. Perceived safety for walking and overall safety were lower in the safety discordance groups and negative concordance group than in the positive concordance group. Traffic related perceived safety was lower in only the negative concordance group (Table 52).

Table 52 Environmental Correlates of Discordances Regarding Safety in the Total Sample: Descriptive Statistics and Multiple Comparison Results

Domains and variables	Groups; N (%)			
	(N)	(P)	(S)	(C)[a]
Self-reported perceived safety				
Perceived safety related to traffic	1.58 (-) ±0.854	1.89 ±0.870	1.85 ±0.875	2.00 ±0.825
Perceived safety related to crime	2.15 ±0.870	2.23 ±0.838	2.27 ±0.771	2.34 ±0.759
Perceived safety related to walking	1.95 (-) ±0.970	2.34 ±0.723	1.98 (-) ±0.818	2.30 ±0.767
Overall perceived safety	5.67 (-) ±2.055	6.45 ±1.715	6.10 (-) ±1.762	6.64 ±1.698
Objective measure - Infrastructures				
Number of crosswalks[b]	32 (58.2%)	46 (+) (74.2%)	97 (40.9%)	140 (50.7%)
Intersection density[b]	40 (+) (72.7%)	31 (50.0%)	172 (+) (72.6%)	140 (50.7%)
Sidewalk completeness[b]	9 (16.4%)	10 (16.1%)	67 (28.3%)	54 (19.6%)
Presence of railroad[c]	7 (12.7%)	12 (+) (19.4%)	14 (5.9%)	13 (4.7%)
Presence of highway[c]	13 (23.6%)	18 (+) (29.0%)	61 (+) (25.7%)	40 (14.5%)
Presence of railroad/highway[c]	18 (32.7%)	25 (+) (40.3%)	71 (+) (30.0%)	52 (18.8%)
Objective measure – Greenery				
The mean of NDVIs[d]	46 (+) (83.6%)	11 (17.7%)	174 (+) (73.4%)	54 (19.6%)
Objective measure - Crime and crash				
Density of violent crime[b]	35 (+) (63.6%)	35 (+) (56.5%)	112 (+) (47.3%)	90 (32.6%)
Density of sex offenders[b]	35 (63.6%)	44 (71.0%)	146 (61.6%)	152 (55.1%)
Density of pedestrian/cyclist crashes[b]	37 (+) (67.3%)	39 (62.9%)	130 (54.9%)	128 (46.4%)
Density of total crashes[b]	31 (56.4%)	45 (+) (72.6%)	127 (53.6%)	138 (50.0%)
Objective measure - Destinations				
Total number of destinations[b]	31 (56.4%)	38 (61.3%)	127 (53.6%)	127 (46.0%)
Objective measure – Density				
Density of housing units[d]	21 (38.2%)	30 (48.4%)	124 (52.3%)	136 (49.3%)
Density of parcels with large businesses[d]	13 (-) (23.6%)	40 (+) (64.5%)	80 (33.8%)	123 (44.6%)
Density of employees in large businesses[d]	8 (-) (14.5%)	28 (+) (45.2%)	41 (-) (17.3%)	79 (28.6%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (S) safety discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.
[b] Objectively measured and categorized with binary scale: "1" citywide mean or higher values and "0" lower value.
[c] Objectively measured with binary scale: "1" presence and "0" absence.
[d] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

In the urban subsample, the group differences were found in perceived safety related to traffic (F=3.013, p=0.030), walking (F=3.162, p=0.025), and overall safety (F=2.822, p=0.039), and objectively measured environmental factors except for crosswalks, sidewalks, and pedestrian crashes. Post-hoc analyses showed that there were no environmental correlates of preference discordance, while correlates of safety discordance were intersection density (+), NDVIs (+), violent crimes (-), sex offenders (-), and employment density (-). Perception of overall safety (-), perceived safety from traffic (-), intersection density (+), NDVIs (+), and housing density (-) were correlates of negative concordance (Table 53). Among the rural subsample, perceptions of safety for walking (F=6.255, p<0.001), overall safety (F=4.668, p=0.003), and all objective environmental variables except for crosswalks, sidewalks, residential, and employment densities were different from each other among the groups. No correlates of preference discordance were found, while correlates of safety discordance included perceived safety for walking (-), overall safety (-), railroad/highway (+), NDVIs (+), violent crimes (+), sex offenders (+), pedestrian crashes (+), total crashes (+), and destinations (+). Perception of safety for walking (-), railroad/highway (+), NDVIs (+), violent crimes (+), and pedestrian crashes were correlates of negative concordance (Table 53).

Table 53 Environmental Correlates of Discordances Regarding Safety in the Urban and Rural Subsamples: A Summary Table of Multiple Comparison Results

Domains and variables	Urban			Rural		
	(N)	(P)	(S)	(N)	(P)	(S)
Self-reported perceived safety						
Perceived safety related to traffic	-					
Perceived safety related to crime						
Perceived safety related to walking				-		-
Overall perceived safety	-					-
Objective measure - Infrastructures						
Number of crosswalks[a]						
Intersection density[a]	+		+			
Sidewalk completeness[a]						
Presence of railroad[b]				+		+
Presence of highway[b]				+		+
Presence of railroad/highway[b]				+		+
Objective measure – Greenery						
Mean of NDVIs[c]	+		+	+		+
Objective measure - Crime and crash						
Density of violent crime[a]			-	+		+
Density of sex offenders[a]			-			+
Density of pedestrian/cyclist crashes[a]				+		+
Density of total crashes[a]						+
Objective measure - Destinations						
Total number of destinations[a]						+
Objective measure – Density						
Density of housing units[c]	-					
Density of parcels with large businesses[c]	-		-			
Density of employees in large businesses[c]			-			

Note that compared to (C) the positive concordance group (a reference group), (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (S) safety discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.

[a] Objectively measured and categorized with binary scale: "1" citywide mean or higher values and "0" lower value.

[b] Objectively measured with binary scale: "1" presence and "0" absence.

[c] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

Among the older adult subsample, differences among the concordance and discordance groups encompassed walking related perceived safety (F=3.502, p=0.016) and all objective environmental factors except for sidewalks, sex offenders, total crashes, destinations, and housing density. Environmental correlates of preference discordance included railroad/highway (+) and violent crimes (+), while safety discordance was related to intersection density (+), NDVIs (+), and crimes (+). NDVIs (+), violent crimes, and pedestrian crashes (+) were found to be correlates of negative concordance (Table 54). Out of the middle-aged subsample, significant differences among groups were variations in perceptions of safety related to traffic, crime, walking, and overall safety. Differences in objectively measured environments included crosswalks, intersection density, sidewalks, NDVIs, and employment density. No correlates of preference discordance were found, while correlates of safety discordance were perceived safety for walking (-), overall safety (-), intersection density (+), and NDVIs (+). Negative concordance was related to perceptions of safety related to traffic (-), crime (-), and overall safety (-), NDVIs (+), and violent crimes (+) (Table 54).

Table 54 Environmental Correlates of Discordances Regarding Safety in the Older and Middle-aged Subsamples: A Summary Table of Multiple Comparison Results

Domains and variables	Older			Middle-aged		
	(N)	(P)	(S)	(N)	(P)	(S)
Self-reported perceived safety						
Perceived safety related to traffic				-		
Perceived safety related to crime				-		
Perceived safety related to walking						-
Overall perceived safety				-		-
Objective measure - Infrastructures						
Number of crosswalks[a]						
Intersection density[a]			+			+
Sidewalk completeness[a]						
Presence of railroad[b]					+	
Presence of highway[b]		+				
Presence of railroad/highway[b]		+				
Objective measure – Greenery						
Mean of NDVIs[c]	+		+	+		+
Objective measure - Crime and crash						
Density of violent crime[a]	+	+	+	+		
Density of sex offenders[a]						
Density of pedestrian/cyclist crashes[a]	+					
Density of total crashes[a]						
Objective measure - Destinations						
Total number of destinations[a]						
Objective measure – Density						
Density of housing units[c]						
Density of parcels with large businesses[c]		+				-
Density of employees in large businesses[c]						

Note that compared to (C) the positive concordance group (a reference group), (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (S) safety discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.

[a] Objectively measured and categorized with binary scale: “1” citywide mean or higher values and “0” lower value.

[b] Objectively measured with binary scale: “1” presence and “0” absence.

[c] Objectively measured and categorized with binary scale: “1” sample-basis mean of the city or higher values and “0” lower value.

5.5.2 Multivariate Analyses

Theses analytical processes for both mixed-effect modeling and GSEM examined direct relationships between objectively measured environmental factors and walking/safety perception. No significant relationships were found since many of the environment features were captured by the composite walkability and safety indices which were utilized in identifying neighborhood discordance.

5.5.2.1 Influences of Neighborhood Discordances on Utilitarian Walking and Perceived Safety

1) Influences of Neighborhood Discordances on Utilitarian Walking

Out of the total sample, both preference discordance group (OR 0.443, p=0.016) and walkability discordance group (OR 0.381, p=0.052) were less likely to walk for utilitarian purposes at least 1 minute per week than the positive concordance group. The negative concordance group, who disregarded walkability and lived in non-walkable neighborhoods, also reported being in a lower level of walking compared to the positive concordance group (OR 0.390, p=0.005). As covariates, males (OR 1.610, p=0.021) or residents who considered neighborhood safety in their residential choices (OR 2.316, p=0.009) and reported perceiving a higher safety from traffic (OR 1.436, p=0.004) were more likely to walk, while Whites (OR 0.519, p=0.032), residents who earned higher household incomes (OR 0.827, p=0.005) and had trouble with walking (OR 0.416, p=0.011) were less likely to walk. The calculation of ICC showed that 24.2% of the total variance was at the city and community setting levels (Table 55).

Comparing urban and rural resident samples, no significant influences of neighborhood discordances or negative concordance on walking were found among urban residents, while rural residents with a preference discordance (OR 0.155, p=0.001) and a walkability discordance (OR 0.137, p=0.004) were less likely to walk than residents with a positive concordance in rural towns. Rural residents with a negative concordance were also less likely to walk than residents with a positive concordance (OR 0.120, p<0.001). As control variables, males (OR 2.536, p=0.006) or residents who perceived higher safety from crime risks (OR 1.903, p=0.009) were more likely to walk, while Whites (OR 0.345, p=0.012) or residents who lived at a distance from CBDs (OR 0.435, p=0.024) were less likely to walk in urban towns. Those employed (OR 1.882, p=0.009) or residents who had no health problems that prevented walking (OR 0.359, p=0.018), and perceived higher safety from traffic (OR 1.397, p=0.025) were more likely to walk for transportation in rural towns (Table 55).

When considering older and middle-aged adults samples, older adults with a preference discordance (OR 0.322, p=0.017) and a negative concordance (OR 0.245, p=0.003) were less likely to walk, while the walking of middle-aged adults with any discordance or negative concordance was identical to the walking of those with a positive concordance. Older adults who perceived higher safety against neighborhood crime (OR 1.597, p=0.012) were more likely to walk, while older adults having higher incomes (OR 0.842, p=0.040) and any difficulty in walking (OR 0.248, p=0.002) were less likely to walk. Male middle-aged adults (OR 1.997, p=0.045) or those who perceived higher safety from traffic (OR 1.531, p=0.033) were more likely to walk, while middle-aged adults who earned higher household incomes (OR 0.769, p=0.011) were less likely to walk. The values of ICC calculations at the city and community setting levels were 27.4% in the older adult model and 34.0% in the middle-aged adult model (Table 55).

2) Influences of Neighborhood Discordance on Perceived Safety

In the total sample, residents who lived with a safety discordance (B -0.372, p=0.019) and a negative concordance regarding safety (B -0.620, p=0.017) were less likely to likely to perceive neighborhood safety than residents with a positive safety concordance. However, the preference discordance group reported a higher level of perceived neighborhood safety rather than the positive concordance, although it was significant at a 0.1 level (B=0.477, p=0.069). Males (B 0.424, p=0.002) or residents who walked for utilitarian purposes at least 1 minute per week (B 0.474, p=0.002), considered neighborhood attractiveness in residential choices (B 1.143, p<0.001), and earned higher household incomes (B 0.104, p=0.015) were more likely to perceive higher safety. The ICC calculation showed that 6.0% of the total variance was at the city level (Table 56).

Looking at the urban and rural resident samples, urban residents with a safety discordance (B -0.558, p=0.016) and a negative concordance (B -0.494, p=0.091) were less likely to perceive higher neighborhood safety, while residents with a preference discordance perceived higher neighborhood safety rather than residents with a positive concordance (B 0.590, p=0.038). However, rural residents with any discordance showed no difference in perceived safety as residents with a positive concordance. Only rural residents with a negative concordance significantly reported perceiving less safety from their neighborhoods than residents with a positive concordance (B -1.120, p=0.018). Employed urban residents (B 0.489, p=0.011) or those who walked for utilitarian purposes (B 0.658, p=0.010), considered neighborhood attractiveness in residential choices (B 1.505, p<0.001), and had some college or higher attainment (B 0.560, p=0.018) were more likely to perceive higher safety. Urban residents living with a longer length of residence (B -0.018, p=0.029) and a child in their households (B -1.073, p=0.003) were less likely to perceive their neighborhood as safe. Male rural residents (B

0.604, p=0.002), those who walked for transportation (B 0.429, p=0.029) and earned higher household incomes (B 0.134, p=0.025) were more likely to perceive safety in their neighborhoods. The values of ICC showed that 4.6% was the city level variance in urban towns and 7.7% in rural towns (Table 56).

Regarding the older and middle-aged adult samples, preference discordance is only significant in predicting the degree of perceived safety among older adults (B 0.769, p=0.013), while a significance of safety discordance was found at a 0.1 significance level among middle-aged adults (B -0.482, p=0.060). Middle-aged adults with a negative concordance were less likely to perceive neighborhood safety (B -1.256, p=0.004). Older adults who were more even older (B 0.031, p=0.020), married (B 0.654, p<0.001), educated (B 0.607, p=0.005), employed (B 0.393, p=0.032), residents who walked for transportation (B 0.456, p=0.009), considered neighborhood attractiveness (B 0.955, p<0.001), and had a shorter length of residence (B -0.015, p=0.012) were more likely to perceive higher safety from their neighborhoods. Male middle-aged adults (B 0.539, p=0.016) or those who considered neighborhood attractiveness (B 1.294, p<0.001) were more likely to perceive safety. The city level variances were 2.1% in the older adult subsample and 7.1% in the middle-aged adult subsample (Table 56).

Table 55 Relationships between Walkability Discordances and Utilitarian Walking: Results from Multivariate Analyses

Covariates and independent variables	Total		Urban		Rural		Older		Middle-aged	
	OR	p-value	OR	p-value	OR	p-value	OR	p-value	OR	p-value
Gender: Male (ref = female)	1.610	0.021	2.536	0.006					1.997	0.045
Race: non-Hispanic, White (ref = others)	0.519	0.032	0.345	0.012						
Employment status: for wages/self-employed (ref = unemployed)					1.882	0.009				
Safety consideration	2.316	0.009								
Any difficulty in walking (ref= no difficulty)	0.416	0.011			0.359	0.018	0.248	0.002		
Screen/sitting hours per week									0.977	0.059
Annual household income[a]	0.827	0.005					0.842	0.040	0.769	0.011
Network distance to CBDs[b]			0.435	0.024						
Perceived safety related to traffic	1.436	0.004			1.397	0.025			1.531	0.033
Perceived safety related to crime			1.903	0.009			1.597	0.012		
Discordances and negative concordance (ref = positive concordance)										
- (N) Negative concordance	0.390	0.005	0.958	0.937	0.120	0.000	0.245	0.003	0.578	0.292
- (P) Preference discordance	0.443	0.016	0.806	0.687	0.155	0.001	0.322	0.017	0.633	0.376
- (E) Walkability discordance	0.381	0.052	0.779	0.787	0.137	0.004	0.372	0.157	0.554	0.432
Akaike information criterion (AIC)	637.738		254.742		418.616		381.745		272.665	
Bayesian information criterion (BIC)	690.320		284.129		445.335		416.153		307.999	
Intraclass correlation coefficient (ICC)	0.242						0.274		0.340	

[a] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" ≥$150k.
[b] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

Table 56 Relationships between Safety Discordances and Perceived Safety: Results from Multivariate Analyses

Covariates and independent variables	Total		Urban		Rural		Older		Middle-aged	
	B	p-value	B	p-value	B	p-value	B	p-value	B	p-value
Gender: Male (ref = female)	0.424	0.002			0.604	0.002			0.539	0.016
Age: ranging 50 – 92 years							0.031	0.020		
Marital status: Married (ref = unmarried)							0.654	0.000		
Education level: some college or higher (ref = lower than some college)			0.560	0.018			0.607	0.005		
Employment status: for wages/self-employed (ref= unemployed)			0.489	0.011			0.393	0.032		
Attractiveness consideration	1.143	0.000	1.505	0.000			0.955	0.000	1.294	0.000
Walking for transportation per week: 1+ min. (ref: 0 min.)	0.474	0.002	0.658	0.010	0.429	0.029	0.456	0.009		
Length of residence			-0.018	0.029			-0.015	0.012		
The presence of children in household			-1.073	0.003						
Annual household income[a]	0.104	0.015			0.134	0.025				
Discordances and negative concordance (ref= positive concordance)										
- (N) Negative concordance	-0.620	0.017	-0.494	0.091	-1.120	0.018	0.094	0.757	-1.256	0.004
- (P) Preference discordance	0.477	0.069	0.590	0.038	0.515	0.392	0.769	0.013	0.218	0.608
- (E) Safety discordance	-0.372	0.019	-0.558	0.016	-0.178	0.395	-0.177	0.352	-0.482	0.060
Akaike information criterion (AIC)	2288.441		1096.752		1197.171		1361.697		1396.232	
Bayesian information criterion (BIC)	2332.260		1140.708		1230.713		1412.325		1427.453	
Intraclass correlation coefficient (ICC)	0.060		0.046		0.077		0.021		0.071	

[a] Measured with a 7-point scale: "1" <\$25k, "2" \$25k-\$34.9k, "3" \$35k-\$49.9k, "4" \$50k-\$74.9k, "5" \$75k-\$99.9k, "6" \$100k-\$149.9k, and "7" ≥\$150k.

3) Influences of Neighborhood Environments vs. Preferences

So far, the influences of neighborhood discordances on walking or perceived safety were examined comparing the preference discordance group (having no preference but living in walkable/safe neighborhoods) and the walkability/safety discordance group (having a preference but living in non-walkable/unsafe neighborhoods) with the positive concordance group (both having a walkability preference and living in walkable neighborhoods) as a reference group. In addition to examining the roles of neighborhood discordances, further analyses were conducted to observe the influences of neighborhood walkability, safety, and preferences on walking or perceived safety, which were not covered by the previous analyses. The analyses compared residents who 1) had no preference but lived in a walkable/safe neighborhood (called the "walkability group" (or safety group)) or 2) had a preference but lived in non-walkable/unsafe neighborhoods (called the "preference group") with the negative concordance group (having no preference and living in non-walkable/unsafe neighborhoods). It also compared 3) the walkability group (or safety group) with the preference group to identify which one of the environments and preferences had a larger influence on walking and perceived safety.

No significant influences of environment and preference were found in terms of walkability. Regarding neighborhood safety, the safety group was more likely to perceive higher neighborhood safety than the negative concordance group in the total sample (B 1.097, $p=0.001$). Comparing the influences of safety and preferences, the safety group was more likely to perceive higher safety than the preference group (B

0.849, p=0.002). In the urban subsample, the safety group had a higher perception of safety compared to the negative concordance group (B 1.084, p=0.002) and the preference group (B 1.148, p<0.001). In the rural sample, both the safety (B 1.635, p=0.026) and preference (B 0.941, p=0.045) groups were shown to have a higher perceived safety than did the negative concordance group. But, no difference was found between influences of safety and preference on perceived safety (B 0.693, p=0.252). Among the older adults, the safety group was likely to report a higher perception of safety than did the preference group (B 0.946, p=0.003). In the middle-aged adult subsample, the safety group showed a higher perceived safety than did the negative concordance groups (B 1.474, p=0.008) (Table 57).

Table 57 Influences of Neighborhood Consideration and Choice on Walking and Perceived Safety: Results from Multivariate Mixed-effects Models

		Walkability				Safety			
		OR	p-value	95% CI		B	p-value	95% CI	
Total	Environment[a]	1.136	0.571	0.732	1.763	1.097	0.001	0.469	1.725
	Preference[b]	0.975	0.954	0.418	2.277	0.248	0.354	-0.276	0.771
	Environment vs. preference[c]	1.164	0.724	0.500	2.713	0.849	0.002	0.309	1.390
Urban	Environment[a]	0.841	0.646	0.403	1.758	1.084	0.002	0.404	1.764
	Preference[b]	0.814	0.807	0.156	4.249	-0.064	0.838	-0.681	0.553
	Environment vs. preference[c]	1.034	0.968	0.200	5.361	1.148	0.000	0.533	1.763
Rural	Environment[a]	1.294	0.318	0.780	2.146	1.635	0.026	0.191	3.078
	Preference[b]	1.142	0.777	0.455	2.868	0.941	0.045	0.022	1.861
	Environment vs. preference[c]	1.133	0.789	0.455	2.822	0.693	0.252	-0.493	1.880
Older	Environment[a]	1.315	0.346	0.745	2.321	0.675	0.064	-0.040	1.390
	Preference[b]	1.518	0.477	0.480	4.803	-0.271	0.375	-0.870	0.328
	Environment vs. preference[c]	0.866	0.807	0.272	2.753	0.946	0.003	0.321	1.571
Middle-aged	Environment[a]	1.094	0.803	0.540	2.217	1.474	0.008	0.390	2.559
	Preference[b]	0.958	0.947	0.266	3.454	0.774	0.089	-0.119	1.667
	Environment vs. preference[c]	1.143	0.837	0.321	4.062	0.700	0.120	-0.184	1.585

[a] Having no preference but living in walkable/safe neighborhoods, compared to having no preference and living in non-walkable/unsafe neighborhoods (reference group= negative concordance)
[b] Having preference but living in non-walkable/unsafe neighborhoods, compared to having no preference and living in non-walkable/unsafe neighborhoods (reference group= negative concordance)
[c] Having no preference but living in walkable/safe neighborhoods, compared to having preference but living in non-walkable/unsafe neighborhoods (reference group= preference but non-walkability/non-safety)

5.5.2.2 Interrelationships among Neighborhood Discordance, Utilitarian Walking, and Perceived Safety

1) Neighborhood Discordances and Utilitarian Walking

As reported from the previous analyses (Table 55), results from path models using GSEM confirmed that both preference discordance (OR 0.432, p=0.013) and walkability discordance (OR 0.380, p=0.053) influenced walking for transportation in the total sample. In addition, the lack of walkability preference and a walkable neighborhood (negative concordance) also had negative influences on walking in the total sample (OR 0.387, p=0.005). Personal/household predictors and environmental correlates of discordances were identified in the path models. Compared to the positive concordance group, the preference discordance group was likely to have more White residents (OR 2.796, p=0.001), no residential preference for neighborhood safety (OR 0.404, p=0.015) personally, perceptions of lower safety from traffic (OR 0.686, p=0.015), higher safety for walking (OR 1.301, p=0.031), fewer crosswalks (OR 0.258, p=0.001), and a lower density of employees (OR 0.424, p=0.005) in their neighborhoods. The walkability discordance group was likely to have a longer length of residence (OR 1.049, p=0.001), lower education attainments (OR 0.253, p=0.001), more violent crimes (OR 10.654, p<0.001), fewer crosswalks (OR 0.036, p<0.001), intersections (OR 0.297, p=0.007), sidewalks (OR 0.060, p=0.001), and employees (OR 0.025, p<0.001) in their neighborhoods. In this total sample, negative concordance had a significant influence on walking (OR 0.387, p=0.005). As correlates of negative concordance, the negative concordance group was likely to have more White residents

(OR 3.066, p=0.002) and no residential preference for neighborhood safety (OR 0.253, p=0.001) personally, and lower perceived safety from traffic (OR 0.598, p=0.002), more pedestrian/cyclist crashes (OR 2.070, p=0.013), fewer crosswalks (OR 0.165, p<0.001), sidewalks (OR 0.255, p<0.001), destinations (OR 0.217, p<0.001), and employees (OR 0.048, p<0.001) in their neighborhoods (Figure 11 and Table 58).

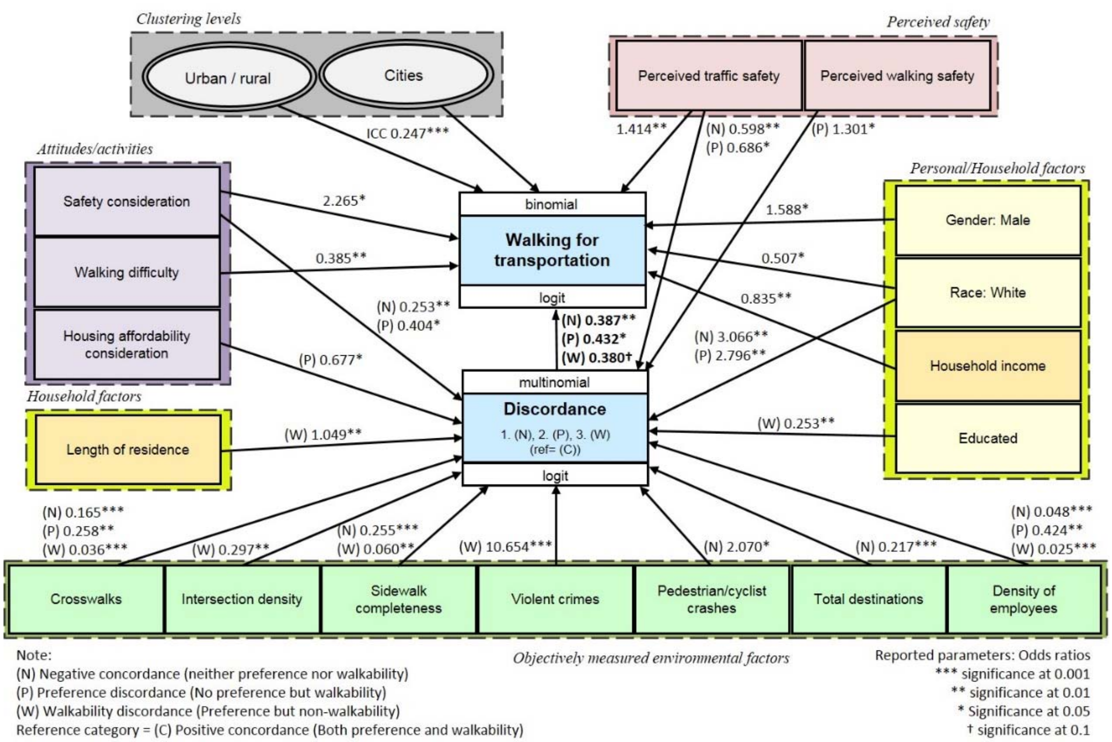

Figure 11 Diagram of Path Models Predicting Transportation Walking for the Total Sample

Table 58 Interrelationships among Walkability Discordances and Utilitarian Walking in the Total Sample: Results from Path Models using GSEM

Response variable ← Explanatory variables	OR	p-value	95% CI	
Walking for transportation ←				
Gender: Male (ref= female)	1.588	0.026	1.057	2.386
Race: non-Hispanic, White (ref= others)	0.507	0.027	0.278	0.925
Safety consideration	2.265	0.011	1.208	4.246
Any difficulty in walking (ref= no difficulty)	0.385	0.007	0.193	0.768
Annual household income[a]	0.835	0.007	0.731	0.953
Perceived safety related to traffic	1.414	0.006	1.102	1.815
Discordances and negative concordance (ref= positive concordance)				
- (N) Negative concordance	0.387	0.005	0.199	0.751
- (P) Preference discordance	0.432	0.013	0.222	0.839
- (W) Walkability discordance	0.380	0.053	0.143	1.011
(N) Negative concordance ←				
Race: non-Hispanic, White (ref= others)	3.066	0.002	1.502	6.257
Safety consideration	0.253	0.001	0.114	0.558
Perceived safety related to traffic	0.598	0.002	0.431	0.829
The number of crosswalks[b]	0.165	0.000	0.070	0.388
Sidewalk completeness[b]	0.255	0.000	0.137	0.475
Density of pedestrian/cyclist crashes[b]	2.070	0.013	1.169	3.667
Total number of destinations[b]	0.217	0.000	0.130	0.361
Density of employees in large (>100) businesses[c]	0.048	0.000	0.020	0.113
(P) Preference discordance ←				
Race: non-Hispanic, White (ref= others)	2.796	0.001	1.490	5.249
Safety consideration	0.404	0.015	0.194	0.841
Perceived safety related to traffic	0.686	0.015	0.507	0.930
Perceived safety related to walking	1.301	0.031	1.024	1.654
The number of crosswalks[b]	0.258	0.001	0.118	0.565
Density of employees in large (>100) businesses[c]	0.424	0.005	0.233	0.772
(W) Walkability discordance ←				
Education level: some college or higher (ref= lower than some college)	0.253	0.001	0.108	0.588
Length of residence	1.049	0.001	1.020	1.080
The number of crosswalks[b]	0.036	0.000	0.010	0.125
Intersection density[b]	0.297	0.007	0.123	0.715
Sidewalk completeness[b]	0.060	0.001	0.011	0.338
Density of violent crimes[b]	10.654	0.000	3.702	30.660
Density of employees in large (>100) businesses[c]	0.025	0.000	0.004	0.167
Akaike information criterion (AIC)		1696.829		
Bayesian information criterion (BIC)		1854.452		
Intraclass correlation coefficient (ICC) of cities and community settings		0.247		

[a] Measured with a 7-point scale: “1” <$25k, “2” $25k-$34.9k, “3” $35k-$49.9k, “4” $50k-$74.9k, “5” $75k-$99.9k, “6” $100k-$149.9k, and “7” >=$150k.
[b] Objectively measured and categorized with binary scale: “1” citywide mean or higher values and “0” lower value.
[c] Objectively measured and categorized with binary scale: “1” sample-basis mean of the city or higher values and “0” lower value.

Comparing urban and rural resident samples, results confirmed that preference (OR 0.155, p=0.001) and walkability (OR 0.137, p=0.004) discordances influenced the walking of rural residents. The negative concordance negatively influenced walking in the rural sample as well (OR 0.120, p<0.001). For the urban sample, no significant influences of discordances and negative concordance were found. The preference discordance group was likely to have more White residents (OR 4.797, p=0.002), a longer distance to CBDs (OR 13.487, p<0.001), a lower perception of safety from traffic (OR 0.594, p=0.028), a higher perception of safety for walking (OR 1.701, p=0.039), and fewer green/vacant spaces (OR 0.010, p<0.001) in their urban neighborhoods. The walkability discordance group was likely to have a higher level of PA at work (OR 3.639, p=0.049) and fewer vehicles in their households (OR 0.216, p=0.050) personally, a longer distance to CBDs (OR 10.646, p=0.004), more crime incidents (OR 16.672, p=0.003), and fewer destinations (OR 0.088, p=0.002) in their urban neighborhoods. The negative concordance group was likely to have more White residents (OR 3.615, p=0.013), a longer distance to CBDs (OR 6.656, p=0.002), more pedestrian/cyclist crashes (OR 4.027, p=0.003), fewer destinations (OR 0.071, p<0.001), and employees (OR 0.123, p<0.001) in urban neighborhoods. The preference discordance group was likely to have more White (OR 4.137, p=0.001) and unmarried residents (OR 0.518, p=0.026), and fewer crosswalks (OR 0.203, p<0.001) in rural neighborhoods. The walkability discordance group was likely to have less educated residents (OR 0.284, p=0.020) and a longer length of residence (OR 1.053, p=0.001) personally, and a shorter distance to CBDs (OR 0.081, p<0.001), fewer crosswalks (OR 0.038, p<0.001), street intersections (OR 0.084, p<0.001), and sidewalks (OR 0.038, p<0.001) in their rural neighborhoods. The negative concordance group was likely to have fewer Hispanic residents (OR 0.105, p=0.008), no residential preference for neighborhood safety (OR 0.218, p=0.009), a closer distance to CBDs (OR 0.160, p<0.001), lower perceived safety from traffic (OR 0.509, p=0.001), higher safety for walking (OR 1.657, p=0.009), more sex offenders (OR 2.290, p=0.014), fewer crosswalks (OR 0.070, p<0.001), intersections (OR 0.125, p<0.001), sidewalks (OR 0.048, p<0.001), and employees (OR 0.230, p=0.011) in rural neighborhoods (Figure 12, Figure 13, and Table 59).

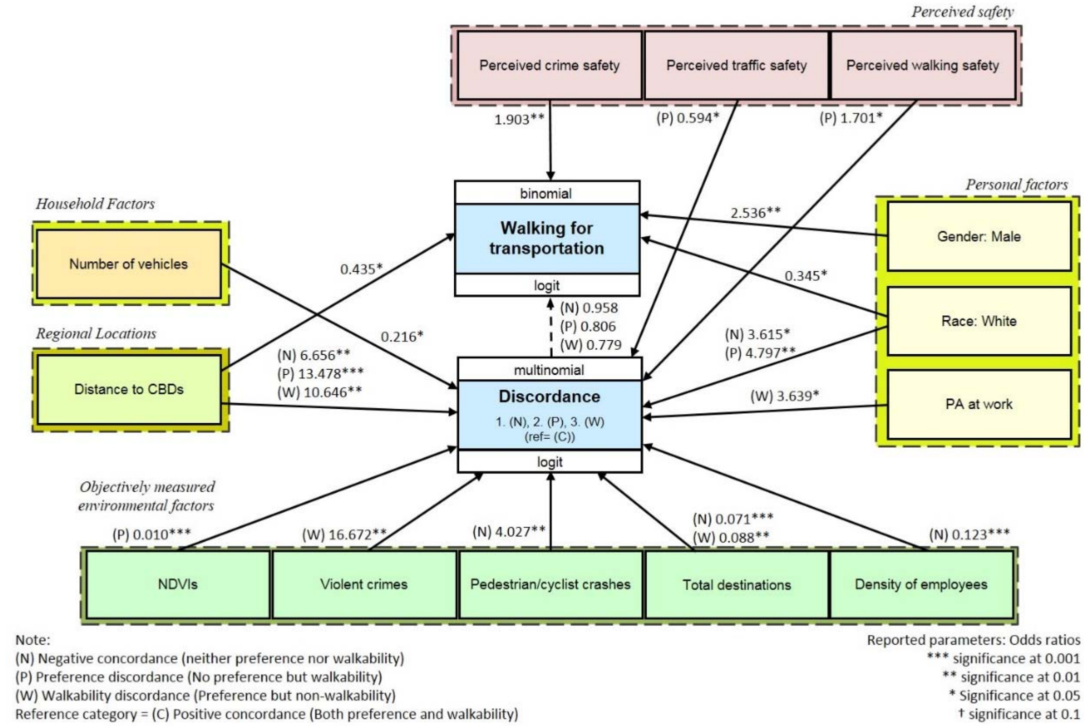

Figure 12 Diagram of Path Models Predicting Transportation Walking for the Urban Subsample

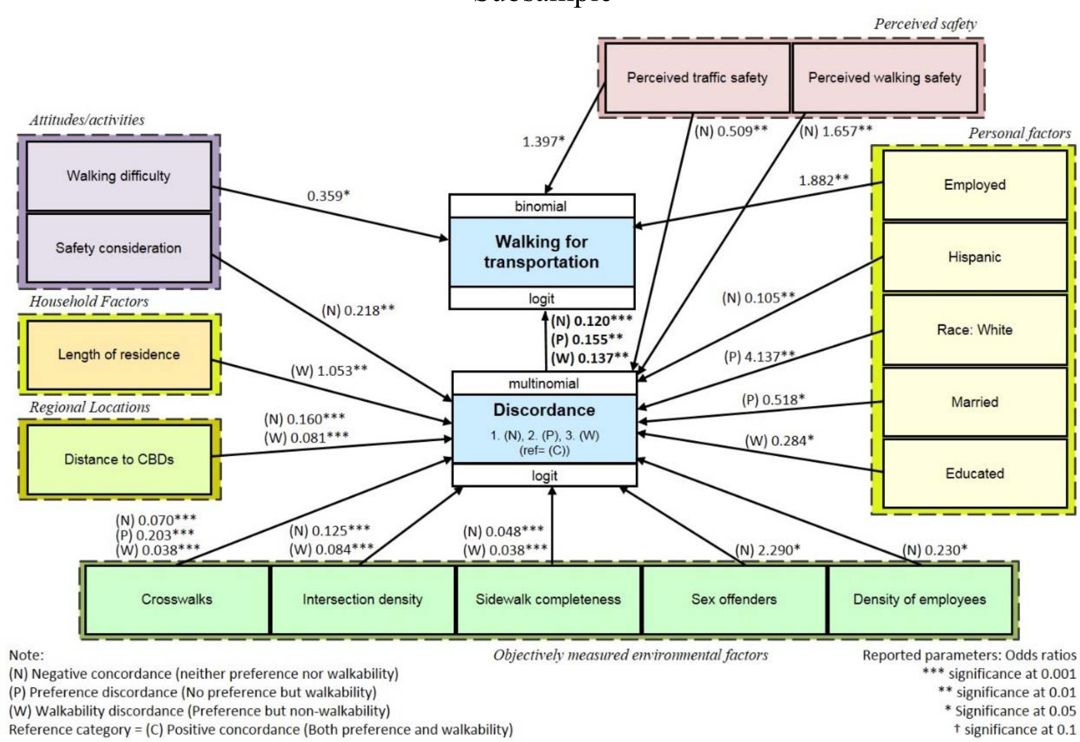

Figure 13 Diagram of Path Models Predicting Transportation Walking for the Rural Subsample

Table 59 Interrelationships among Walkability Discordances and Utilitarian Walking in the Urban and Rural Subsamples: Results from Path Models using GSEM

Response variable ← Explanatory variables	Urban		Rural	
	OR	p-value	OR	p-value
Walking for transportation ←				
Gender: Male (ref= female)	2.536	0.006		
Race: non-Hispanic, White (ref= others)	0.345	0.012		
Employment Status: for wages/self-employed (ref= unemployed)			1.882	0.009
Any difficulty in walking (ref= no difficulty)			0.359	0.018
Network distance to CBDs[c]	0.435	0.024		
Perceived safety related to traffic			1.397	0.025
Perceived safety related to crime	1.903	0.009		
Discordances and negative concordance: ref= positive concordance				
- (N) Negative concordance	0.958	0.937	0.120	0.000
- (P) Preference discordance	0.806	0.687	0.155	0.001
- (W) Walkability discordance	0.779	0.787	0.137	0.004
(N) Negative concordance ←				
Hispanic, Latino or Spanish origin (ref= others)			0.105	0.008
Race: non-Hispanic, White (ref= others)	3.615	0.013		
Safety consideration			0.218	0.009
Network distance to CBDs[c]	6.656	0.002	0.160	0.000
Perceived safety related to traffic			0.509	0.001
Perceived safety related to walking			1.657	0.009
The number of crosswalks[b]			0.070	0.000
Intersection density[b]			0.125	0.000
Sidewalk completeness[b]			0.048	0.000
Density of sex offenders[b]			2.290	0.014
Density of pedestrian/cyclist crashes[b]	4.027	0.003		
Total number of destinations[b]	0.071	0.000		
Density of employees in large (>100) businesses[c]	0.123	0.000	0.230	0.011
(P) Preference discordance ←				
Race: non-Hispanic, White (ref= others)	4.797	0.002	4.137	0.001
Marital status: Married (ref= unmarried)			0.518	0.026
Network distance to CBDs[c]	13.478	0.000		
Perceived safety related to traffic	0.594	0.028		
Perceived safety related to walking	1.701	0.039		
The number of crosswalks[b]			0.203	0.000
The mean of NDVIs[c]	0.010	0.000		
(W) Walkability discordance ←				
Education level: some college or higher (ref= lower than some college)			0.284	0.020
PA at work: standing/walking/heavy labor (ref= not work/sitting)	3.639	0.049		
Length of residence			1.053	0.001
The number of vehicles per person	0.216	0.050		
Network distance to CBDs[c]	10.646	0.004	0.081	0.000
The number of crosswalks[b]			0.038	0.000
Intersection density[b]			0.084	0.000
Sidewalk completeness[b]			0.038	0.000
Density of violent crimes[b]	16.672	0.003		
Total number of destinations[b]	0.088	0.002		
Akaike information criterion (AIC)	655.820		990.301	
Bayesian information criterion (BIC)	751.505		1100.998	

[a] Measured with a 7-point scale: “1” <$25k, “2” $25k-$34.9k, “3” $35k-$49.9k, “4” $50k-$74.9k, “5” $75k-$99.9k, “6” $100k-$149.9k, and “7” >=$150k.
[b] Objectively measured and categorized with binary scale: “1” citywide mean or higher values and “0” lower value.
[c] Objectively measured and categorized with binary scale: “1” sample-basis mean of the city or higher values and “0” lower value.

When considering older adult and middle-aged samples, only preference discordance (OR 0.298, p=0.014) influenced the utilitarian walking of older adults, while no significant influence of discordance was identified on the walking of middle-aged adults. The negative concordance had negative influences on walking among older adults (OR 0.227, p=0.002). In the older adult sample, the preference discordance group was likely to have more even older (OR 1.068, p=0.001), obese (OR 15.930, p=0.009) residents, and fewer Hispanic-origin residents (OR 0.047, p=0.006) as personal factors, and fewer crosswalks (OR 0.365, p=0.041) and employees (OR 0.373, p=0.028) in neighborhoods. The walkability discordance group was likely to have less educated adults (OR 0.146, p=0.003) personally, a longer length of residence (OR 1.055, p=0.007), fewer vehicles (OR 0.019, p=0.001) in their households, and fewer crosswalks (OR 0.131, p=0.013), street intersections (OR 0.157, p=0.004), and employees (OR 0.086, p=0.019) in their neighborhoods. The negative concordance group was likely to have many more obese (OR 23.926, p=0.003) residents, fewer Hispanic (OR 0.097, p=0.008), and less educated (OR 0.038, p=0.018) residents personally, more pedestrian or cyclist crashes (OR 2.674, p=0.026), fewer crosswalks (OR 0.251, p=0.013), sidewalks (OR 0.335, p=0.011), neighborhood destinations (OR 0.184, p<0.001), and employees (OR 0.026, p<0.001) in their neighborhoods. In the middle-aged sample, the preference discordance group was likely to have more White residents (OR 2.810, p=0.011), no residential preference for housing affordability (OR 0.504, p=0.031) and neighborhood safety (OR 0.306, p=0.043) personally, and more areas developed after moving in (OR 1.046, p<0.001) and fewer crosswalks (OR 0.083, p=0.001). The walkability discordance group was likely to have no preference for housing affordability (OR 0.314, $p=0.046$) personally, a longer length of residence (OR 1.112, $p=0.001$), fewer vehicles in their households (OR 0.200, $p=0.024$), and more violent crimes (OR 33.978, $p<0.001$), fewer crosswalks (OR 0.007, $p<0.001$), sidewalks (OR 0.095, $p<0.014$), and employees (OR 0.082, $p=0.002$) (Figure 14, Figure 15, and Table 60).

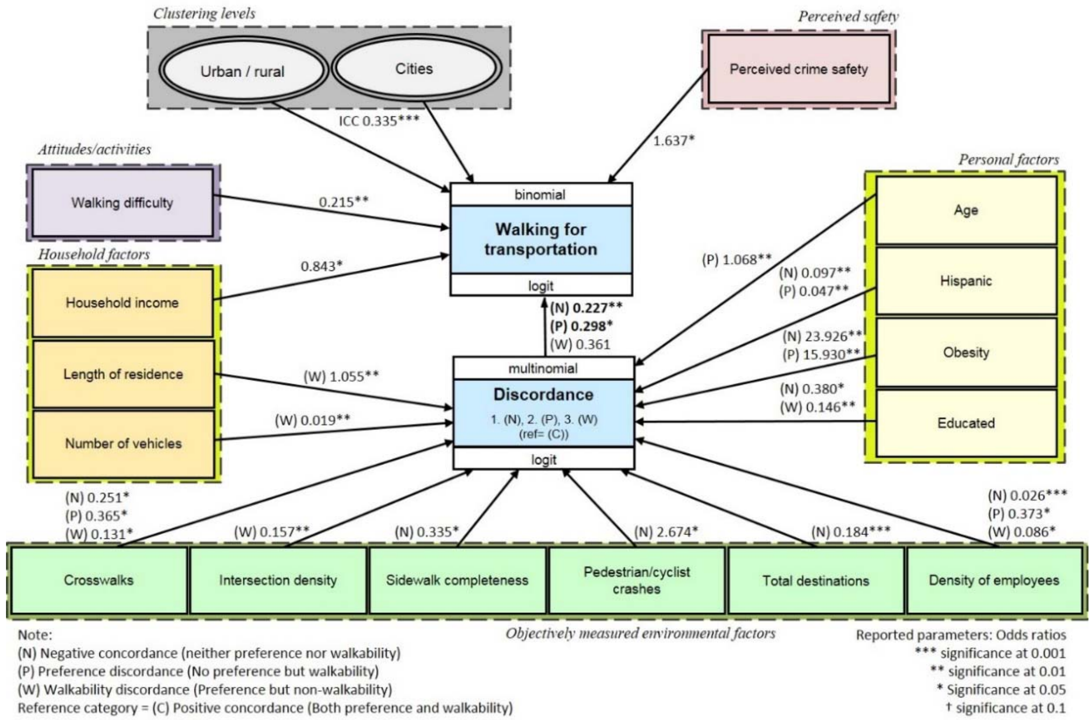

Figure 14 Diagram of Path Models Predicting Transportation Walking for the Older Subsample

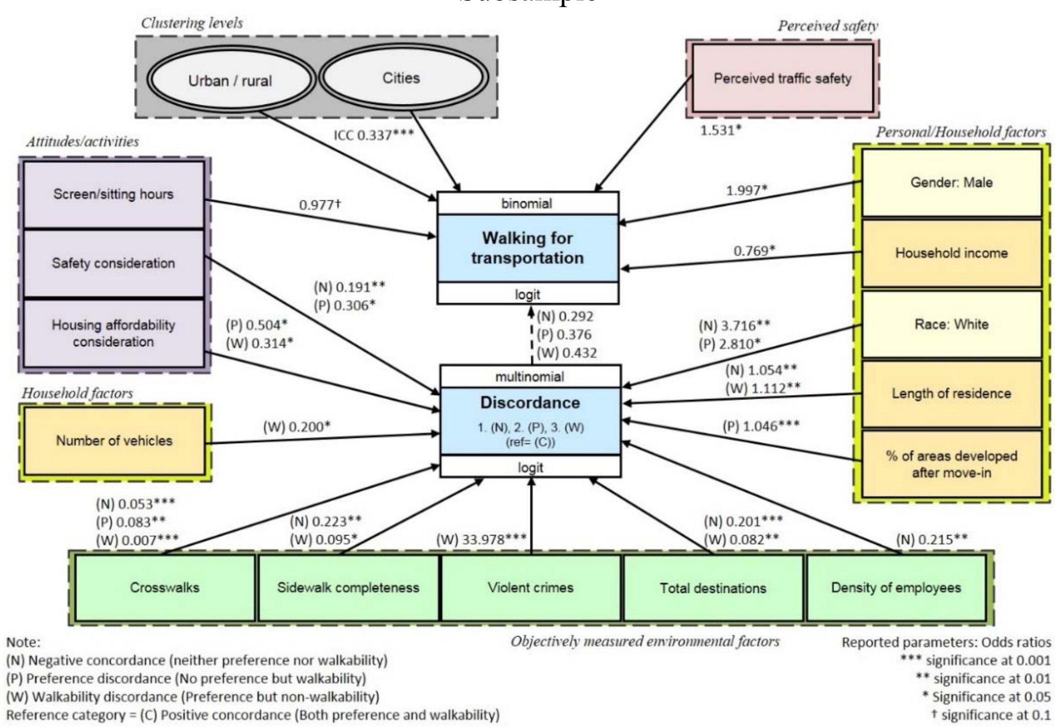

Figure 15 Diagram of Path Models Predicting Transportation Walking for the Middle-aged Subsample

Table 60 Interrelationships among Walkability Discordances and Utilitarian Walking in the Older and Middle-aged Adult Subsamples: Results from Path Models Using GSEM

Response variable ← Explanatory variables	Older		Middle	
	OR	p-value	OR	p-value
Walking for transportation ←				
Gender: Male (ref= female)			1.997	0.045
Walking difficulty: A little/somewhat difficult (ref= Not at all)	0.215	0.001		
Screen/sitting hours per week			0.977	0.059
Annual household income[a]	0.843	0.047	0.769	0.011
Perceived safety related to traffic			1.531	0.033
Perceived safety related to crime	1.637	0.010		
Discordances and negative concordance: ref= positive concordance				
- (N) Negative concordance	0.227	0.002	0.578	0.292
- (P) Preference discordance	0.298	0.014	0.633	0.376
- (W) Walkability discordance	0.361	0.157	0.554	0.432
(N) Negative concordance ←				
Hispanic, Latino or Spanish origin (ref= others)	0.097	0.008		
Race: non-Hispanic, White (ref= others)			3.716	0.005
Obese: BMI>=30 (ref= non-obese (BMI<30))	23.926	0.003		
Education level: some college or higher (ref= lower than some college)	0.380	0.018		
Safety consideration			0.191	0.007
Length of residence			1.054	0.007
The number of crosswalks[b]	0.251	0.013	0.053	0.000
Sidewalk completeness[b]	0.335	0.011	0.223	0.003
Density of pedestrian/cyclist crashes[b]	2.674	0.026		
Total number of destinations[b]	0.184	0.000	0.201	0.000
Density of employees in large (>100) businesses[c]	0.026	0.000	0.215	0.002
(P) Preference discordance ←				
Age: ranging 50 – 92 years	1.068	0.001		
Hispanic, Latino or Spanish origin (ref= others)	0.047	0.006		
Race: non-Hispanic, White (ref= others)			2.810	0.011
Obese: BMI>=30 (ref= non-obese (BMI<30))	15.930	0.009		
Housing affordability consideration			0.504	0.031
Safety consideration			0.306	0.043
The % of parcel areas built after moving			1.046	0.000
The number of crosswalks[b]	0.365	0.041	0.083	0.001
Density of employees in large (>100) businesses[c]	0.373	0.028		
(W) Walkability discordance ←				
Education level: some college or higher (ref= lower than some college)	0.146	0.003		
Housing affordability consideration			0.314	0.046
Length of residence	1.055	0.007	1.112	0.001
The number of vehicles per person	0.019	0.001	0.200	0.024
The number of crosswalks[b]	0.131	0.013	0.007	0.000
Intersection density[b]	0.157	0.004		
Sidewalk completeness[b]			0.095	0.014
Density of violent crimes[b]			33.978	0.000
Total number of destinations[b]			0.082	0.002
Density of employees in large (>100) businesses[c]	0.086	0.019		
Akaike information criterion (AIC)	935.281		773.046	
Bayesian information criterion (BIC)	1053.333		887.476	
Intraclass correlation coefficient (ICC) of cities and community settings	0.335		0.340	

[a] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" >=$150k.
[b] Objectively measured and categorized with binary scale: "1" citywide mean or higher values and "0" lower value.
[c] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

2) Neighborhood Discordance and Perceived Neighborhood Safety

Discordant safety attributes and perceived neighborhood safety were also estimated with exogenous variables capturing personal/household characteristics and environment features by path models using GSEM. The results corresponded to the results from mixed-effect modeling (Table 56). The results confirmed that preference discordance had a greater influence on residents' perceptions of neighborhood safety rather than did concordance (B 0.483, $p=0.066$), while safety discordance had a negative influence on the perception of safety (B -0.368, $p=0.021$) compared to positive concordance in the total sample. As well, the negative concordance group also perceived lower levels of safety than did the positive concordance group (B -0.614, $p=0.018$). As personal/household predictors and environmental correlates of discordant safety attributes identified by the path models, the preference discordance group was likely to have more Hispanic residents (OR 3.868, $p=0.004$), no preference for neighborhood attractiveness (OR 0.124, $p<0.001$), and no walking for transportation (OR 0.135, $p<0.001$) as personal factors, and more parcel areas developed after move-in (OR 1.025, $p=0.048$) and employees working for large businesses (OR 2.437, $p=0.011$) in their neighborhoods. The safety discordance group was likely to have more preference for neighborhood attractiveness (OR 3.950, $p<0.001$), younger ages (OR=0.967, $p=0.002$), a longer length of residence (OR 1.030, $p=0.001$), more intersections (OR 3.844, $p<0.001$), violent crimes (OR 2.413, $p<0.001$), fewer crosswalks (OR 0.386, $p<0.001$), and employees (OR 0.389, $p<0.001$) in their neighborhoods. The negative concordance group was likely to have younger ages (OR 0.961, $p=0.036$), less walking (OR 0.263, p=0.001), a longer length of residence (OR 1.062, p<0.001), more intersections (OR 3.640, p=0.001), violent crime (OR 4.379, p<0.001), lower housing density (OR 0.235, p<0.001), and employment density (OR 0.189, p=0.001) in their neighborhoods (Figure 16 and Table 61).

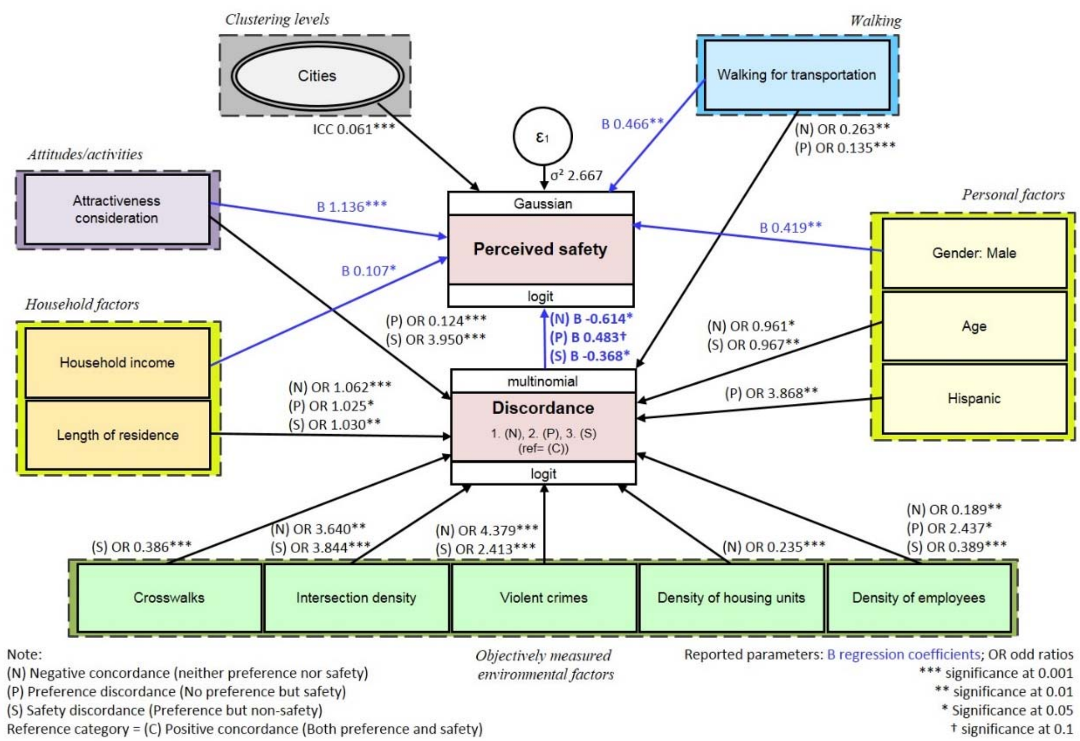

Figure 16 Diagram of Path Models Predicting Perceived Safety for the Total Sample

Table 61 Interrelationships among Safety Discordances and Perceived Safety in the Total Sample: Results from Path Models Using GSEM

Response variable ← Explanatory variables	B	p-value	95% CI	
Perceived safety ←				
Gender: Male (ref= female)	0.419	0.002	0.147	0.690
Attractiveness consideration	1.136	0.000	0.701	1.572
Walking for transportation per week: 1+ min. (ref: 0 min.)	0.466	0.003	0.158	0.773
Annual household income[a]	0.107	0.013	0.023	0.191
Discordances and negative concordance: ref= positive concordance				
- (N) Negative concordance	-0.614	0.018	-1.125	-0.104
- (P) Preference discordance	0.483	0.066	-0.032	0.998
- (S) Safety discordance	-0.368	0.021	-0.680	-0.056
	OR	p-value	95% CI	
(N) Negative concordance ←				
Age: ranging 50 – 92 years	0.961	0.036	0.926	0.997
Walking for transportation per week: 1+ min. (ref: 0 min.)	0.263	0.001	0.121	0.573
Length of residence	1.062	0.000	1.034	1.092
Intersection density[b]	3.640	0.001	1.726	7.676
Density of violent crimes[b]	4.379	0.000	2.016	9.510
Density of housing units[c]	0.235	0.000	0.114	0.487
Density of employees in large (>100) businesses[c]	0.189	0.001	0.072	0.497
(P) Preference discordance ←				
Hispanic, Latino or Spanish origin (ref= others)	3.868	0.004	1.521	9.832
Attractiveness consideration	0.124	0.000	0.063	0.247
Walking for transportation per week: 1+ min. (ref: 0 min.)	0.135	0.000	0.055	0.333
Length of residence	1.025	0.048	1.000	1.051
Density of employees in large (>100) businesses[c]	2.437	0.011	1.231	4.826
(S) Safety discordance ←				
Age: ranging 50 – 92 years	0.967	0.002	0.946	0.988
Attractiveness consideration	3.950	0.000	1.824	8.554
Length of residence	1.030	0.001	1.012	1.047
The number of crosswalks[b]	0.386	0.000	0.246	0.605
Intersection density[b]	3.844	0.000	2.511	5.883
Density of violent crimes[b]	2.413	0.000	1.515	3.844
Density of employees in large (>100) businesses[c]	0.389	0.000	0.232	0.654
Akaike information criterion (AIC)		3448.379		
Bayesian information criterion (BIC)		3588.543		
Intraclass correlation coefficient (ICC) of cities		0.061		

[a] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" >=$150k.
[b] Objectively measured and categorized with binary scale: "1" citywide mean or higher values and "0" lower value.
[c] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

Looking at the urban and rural resident samples, results confirmed that preference discordance (B 0.590, p=0.038) positively influenced a higher perception of neighborhood safety, while safety discordance (B -0.558, p=0.016) and negative concordance (B -0.494, p=0.091) negatively influenced the perceived safety of urban residents. In the rural resident sample, only the negative concordance had an effect on residents perceiving lower neighborhood safety than the positive concordance groups (B -1.054, p=0.032). As correlates of discordance, the preference discordance group was likely to have no preference for housing affordability (OR 0.454, p=0.040), neighborhood attractiveness (OR 0.099, p<0.001), and lower greenery (OR 0.180, p=0.001) in urban neighborhoods. The safety discordance group was likely to have more White residents (OR 2.926, p=0.028), married residents (OR 2.799, p=0.016), and no one to walk with (OR 0.476, p=0.024) personally, and a higher intersection density (OR 5.356, p<0.001) and a lower density of employment (OR 0.178, p<0.001) in urban neighborhoods. The negative concordance group was likely to have a longer length of residence (OR 1.035, p=0.022), a higher intersection density (OR 4.556, p<0.001), a lower density of housing units (OR 0.296, p=0.002), and density of employment (OR 0.194, p=0.003) in their neighborhoods. The preference discordance group was likely to have more time on screen (OR 1.072, p<0.001), no preference for neighborhood attractiveness (OR 0.071, p=0.004), and no walking for transportation (OR 0.120, p=0.023) among rural residents. The safety discordance group was likely to have more preference for neighborhood attractiveness (OR 6.492, p=0.003) and younger age (OR 0.944, p<0.001) as personal factors, a longer length of residence (OR 1.033, p=0.005), fewer vehicles (OR 0.544, $p=0.026$), and a longer distance from CBDs (OR 4.098, $p<0.001$) as household factors, and more sex offenders (OR 2.322, $p=0.004$), crashes related to pedestrians/cyclists (OR 2.642, $p=0.015$), and fewer employees (OR 0.150, $p<0.001$) in rural neighborhoods. The negative concordance group was likely to have more male residents (OR 4.583, $p=0.047$), no preference for neighborhood attractiveness (OR 0.061, $p<0.001$), no walking for utilitarian purposes (OR 0.125, $p=0.010$), and a longer length of residence (OR 1.056, $p=0.021$) (Figure 17, Figure 18, and Table 62).

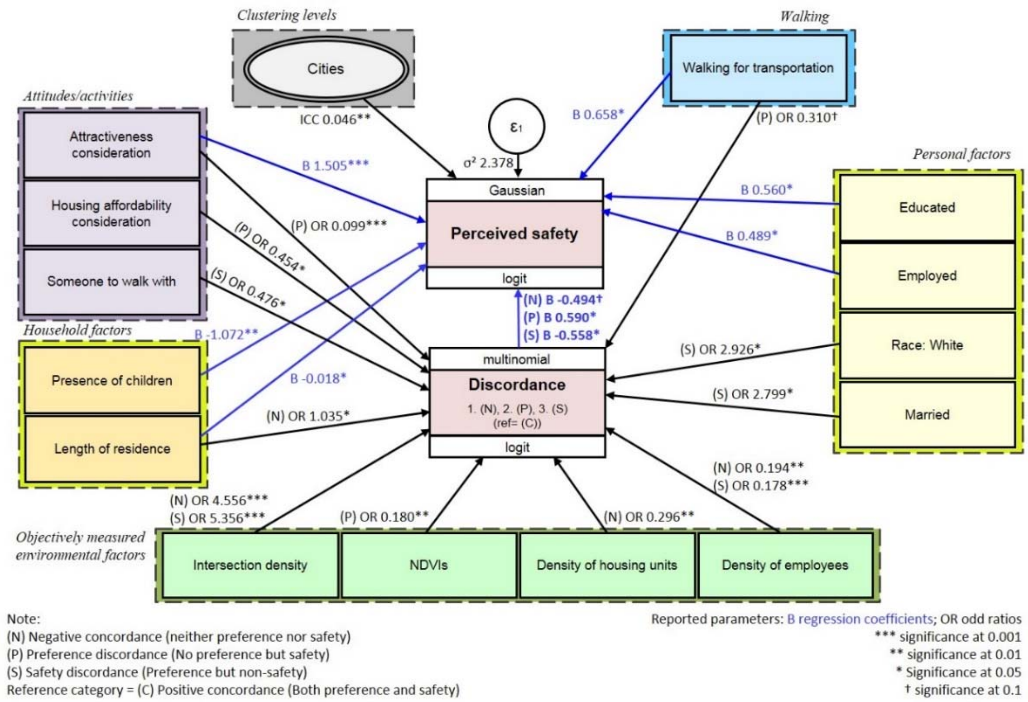

Figure 17 Diagram of Path Models Predicting Perceived Safety for the Urban Subsample

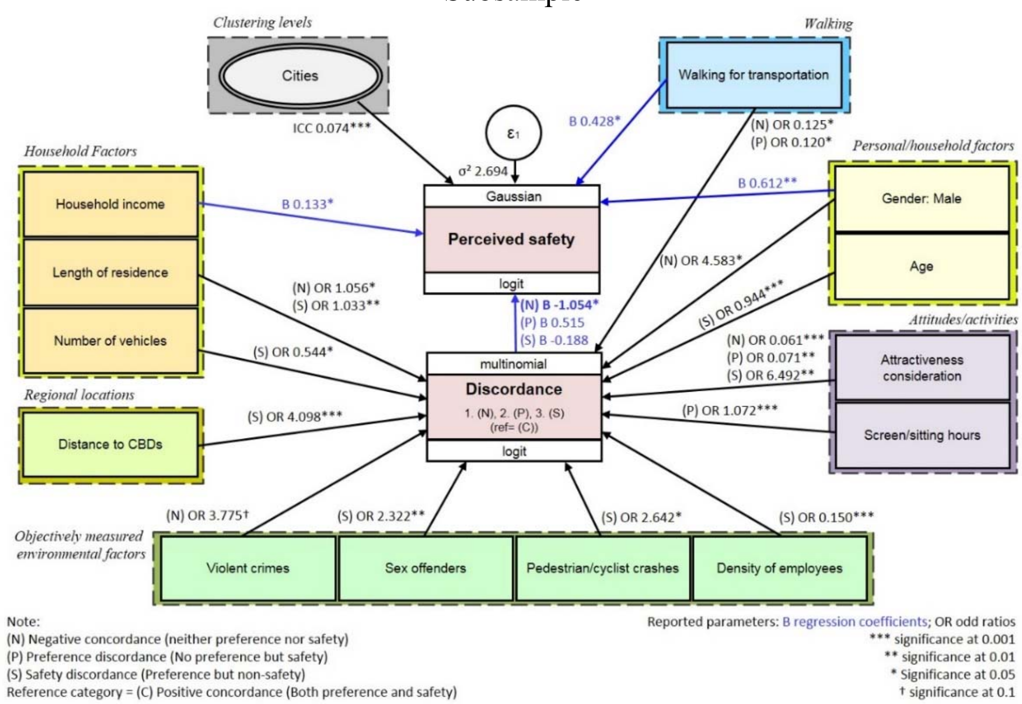

Figure 18 Diagram of Path Models Predicting Perceived Safety for the Rural Subsample

Table 62 Interrelationships among Safety Discordances and Perceived Safety in the Urban and Rural Subsamples: Results from Path Models Using GSEM

Response variable 🡐 Explanatory variables	Urban		Rural	
	B	p-value	B	p-value
Perceived safety 🡐				
Gender: Male (ref= female)			0.612	0.002
Education level: some college or higher (ref= lower than some college)	0.560	0.018		
Employment Status: for wages/self-employed (ref= unemployed)	0.489	0.011		
Attractiveness consideration	1.505	0.000		
Walking for transportation per week: 1+ min. (ref: 0 min.)	0.658	0.010	0.428	0.030
Length of residence	-0.018	0.030		
The presence of children in household	-1.072	0.003		
Annual household income[a]			0.133	0.027
Discordances and negative concordance: ref= positive concordance				
- (N) Negative concordance	-0.494	0.091	-1.054	0.032
- (P) Preference discordance	0.590	0.038	0.515	0.393
- (S) Safety discordance	-0.558	0.016	-0.188	0.379
	OR	p-value	OR	p-value
(N) Negative concordance 🡐				
Gender: Male (ref= female)			4.583	0.047
Attractiveness consideration			0.061	0.000
Walking for transportation per week: 1+ min. (ref: 0 min.)			0.125	0.010
Length of residence	1.035	0.022	1.056	0.021
Intersection density[b]	4.556	0.000		
Density of violent crimes[b]			3.775	0.062
Density of housing units[c]	0.296	0.002		
Density of employees in large (>100) businesses[c]	0.194	0.003		
(P) Preference discordance 🡐				
Housing affordability consideration	0.454	0.040		
Attractiveness consideration	0.099	0.000	0.071	0.004
Screen/sitting hours per week			1.072	0.000
Walking for transportation per week: 1+ min. (ref: 0 min.)	0.310	0.053	0.120	0.023
The mean of NDVIs[c]	0.180	0.001		
(S) Safety discordance 🡐				
Age: ranging 50 – 92 years			0.944	0.000
Race: non-Hispanic, White (ref= others)	2.926	0.028		
Marital status: Married (ref= unmarried)	2.799	0.016		
Attractiveness consideration			6.492	0.003
Someone to walk with (ref= no one)	0.476	0.024		
Length of residence			1.033	0.005
The number of vehicles per person			0.544	0.026
Network distance to CBDs[c]			4.098	0.000
Intersection density[b]	5.356	0.000		
Density of sex offenders[b]			2.322	0.004
Density of pedestrian/cyclist crashes[b]			2.642	0.015
Density of employees in large (>100) businesses[c]	0.178	0.000	0.150	0.000
Akaike information criterion (AIC)	1720.609		1649.999	
Bayesian information criterion (BIC)	1823.172		1754.167	
Intraclass correlation coefficient (ICC) of cities	0.046		0.074	

[a] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" >=$150k.

[b] Objectively measured and categorized with binary scale: "1" citywide mean or higher values and "0" lower value.

[c] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

Regarding the older and middle-aged adult samples, only preference discordance influenced perceived safety of older adult residents (B 0.769, p=0.013). The preference discordance group was more likely than the positive concordance group to report perceiving higher safety from their neighborhoods. Among middle-aged adults, neither preference discordance nor safety discordance had significant effects on perceived safety at a 0.05 level, but the negative concordance negatively influenced perceiving higher neighborhood safety (B -1.281, p=0.003). In the older adult sample, the preference discordance group was likely to have no preference for attractive neighborhoods (OR 0.101, p<0.001) and no walking for transportation (OR 0.092, p<0.001) personally, and a longer length of residence (OR 1.032, p=0.030) and fewer green or open spaces (OR 0.245, p=0.003) in their neighborhoods. The safety discordance group was likely to have more preference for attractive neighborhoods (OR 4.538, p=0.008), younger age (OR 0.939, p=0.003), and lower education attainments (OR 0.488, p=0.039) personally, and a longer length of residence (OR 1.031, p=0.004), fewer vehicles (OR 0.510, p=0.044), a shorter distance to CBDs (OR 0.458, p=0.011), more intersections (OR 4.126, p<0.001), violent crimes (OR 2.327, p=0.015), fewer crosswalks (OR 0.421, p=0.005), and employees (OR 0.227, p<0.001) in their neighborhoods. The negative concordance group was likely to have younger age (OR 0.928, p=0.032), no preference for attractiveness (OR 0.317, p=0.022), a longer length of residence (OR 1.053, p=0.001), a higher density of intersections (OR 3.439, p=0.009), violent crimes (OR 2.886, p=0.021), and a lower density of employees (OR 0.206, p=0.003). In the middle-aged adult sample, the preference discordance group was likely to have more Hispanics (OR 3.907, $p=0.029$), no preference for neighborhood attractiveness (OR 0.107, $p<0.001$), no walking for transportation (OR 0.225, $p=0.021$) personally, and fewer green or open spaces (OR 0.085, $p=0.020$) in their neighborhoods. The safety discordance group was likely to have more married (OR 2.450, $p=0.010$) and female residents (OR 0.551, $p=0.047$) personally, and more intersections (OR 3.403, $p<0.001$), violent crime (OR 2.449, $p=0.010$), and fewer crosswalks (OR 0.241, $p<0.001$) in their neighborhoods. The negative concordance group was likely to have no walking for transportation (OR 0.016, $p=0.001$), a higher density of intersections (OR 6.156, $p=0.009$), violent crimes (OR 18.638, $p<0.001$), a lower density of housing units (OR 0.039, $p<0.001$), and employees (OR 0.089, $p=0.016$) (Figure 19, Figure 20, and Table 63).

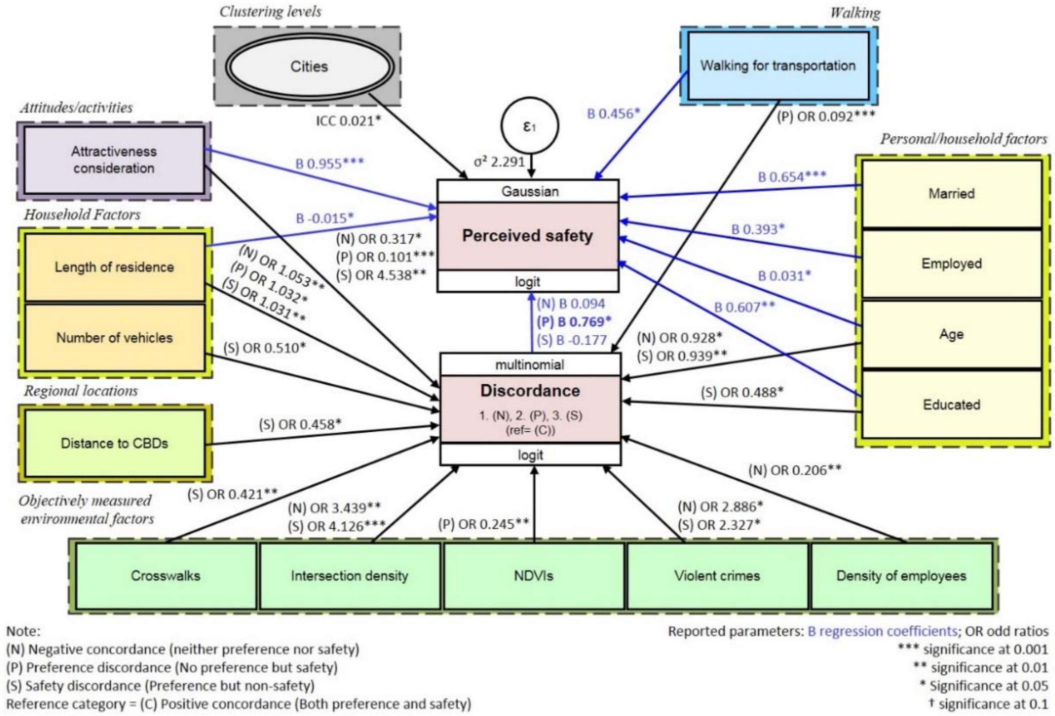

Figure 19 Diagram of Path Models Predicting Perceived Safety for the Older Adult Subsample

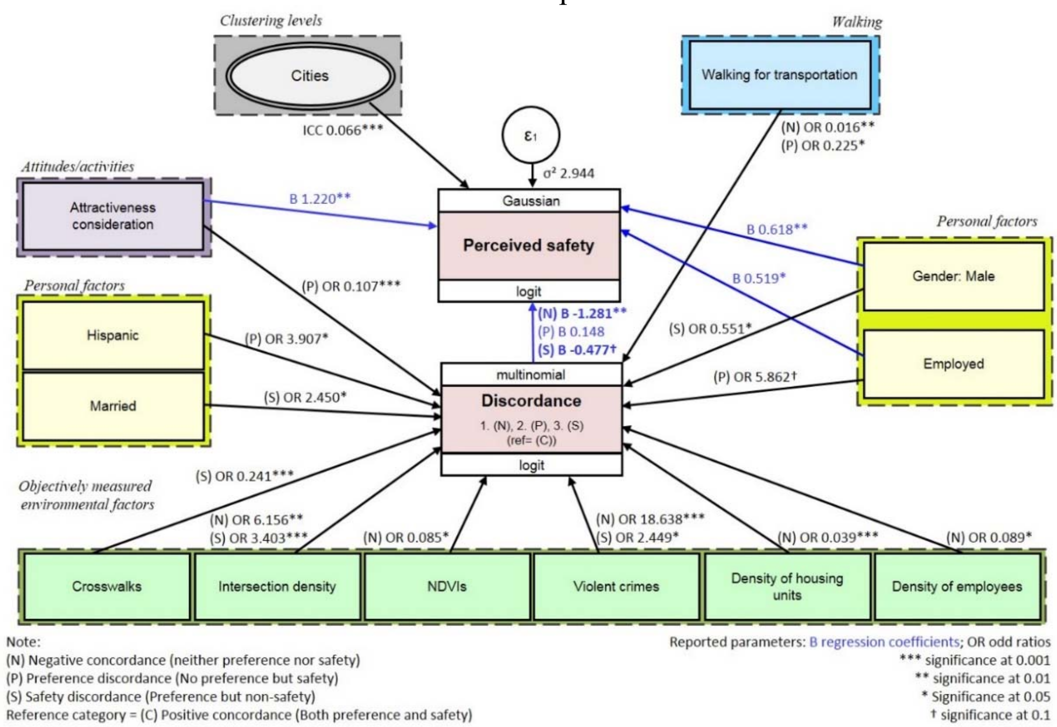

Figure 20 Diagram of Path Models Predicting Perceived Safety for the Middle-aged Adult Subsample

Table 63 Interrelationships among Safety Discordances and Perceived Safety in the Older and Middle-aged Adult Subsamples: Results from Path Models Using GSEM

Response variable 🡐 Explanatory variables	Older		Middle	
	B	p-value	B	p-value
Perceived safety 🡐				
Gender: Male (ref= female)			0.618	0.006
Age: ranging 50 – 92 years	0.031	0.020		
Marital status: Married (ref= unmarried)	0.654	0.000		
Education level: some college or higher (ref= lower than some college)	0.607	0.006		
Employment Status: for wages/self-employed (ref= unemployed)	0.393	0.032	0.519	0.041
Attractiveness consideration	0.955	0.000	1.220	0.001
Walking for transportation per week: 1+ min. (ref: 0 min.)	0.456	0.010		
Length of residence	-0.015	0.013		
Discordances and negative concordance: ref= positive concordance				
- (N) Negative concordance	0.094	0.757	-1.281	0.003
- (P) Preference discordance	0.769	0.013	0.148	0.729
- (S) Safety discordance	-0.177	0.357	-0.477	0.068
	OR	p-value	OR	p-value
(N) Negative concordance 🡐				
Age: ranging 50 – 92 years	0.928	0.032		
Attractiveness consideration	0.317	0.022		
Walking for transportation per week: 1+ min. (ref: 0 min.)			0.016	0.001
Length of residence	1.053	0.001		
Intersection density[b]	3.439	0.009	6.156	0.009
Density of violent crimes[b]	2.886	0.021	18.638	0.000
Density of housing units[c]			0.039	0.000
Density of employees in large (>100) businesses[c]	0.206	0.003	0.089	0.016
(P) Preference discordance 🡐				
Hispanic, Latino or Spanish origin (ref= others)			3.907	0.029
Employment Status: for wages/self-employed (ref= unemployed)			5.862	0.056
Attractiveness consideration	0.101	0.000	0.107	0.000
Walking for transportation per week: 1+ min. (ref: 0 min.)	0.092	0.000	0.225	0.021
Length of residence	1.032	0.030		
The mean of NDVIs[c]	0.245	0.003	0.085	0.020
(S) Safety discordance 🡐				
Gender: Male (ref= female)			0.551	0.047
Age: ranging 50 – 92 years	0.939	0.003		
Marital status: Married (ref= unmarried)			2.450	0.010
Education level: some college or higher (ref= lower than some college)	0.488	0.039		
Attractiveness consideration	4.538	0.008		
Length of residence	1.031	0.004		
The number of vehicles per person	0.510	0.044		
Network distance to CBDs[c]	0.458	0.011		
The number of crosswalks[b]	0.421	0.005	0.241	0.000
Intersection density[b]	4.126	0.000	3.403	0.000
Density of violent crimes[b]	2.327	0.015	2.449	0.010
Density of employees in large (>100) businesses[c]	0.227	0.000		
Akaike information criterion (AIC)	2075.686		1529.398	
Bayesian information criterion (BIC)	2215.884		1625.432	
Intraclass correlation coefficient (ICC) of cities	0.021		0.066	

[a] Measured with a 7-point scale: “1” <$25k, “2” $25k-$34.9k, “3” $35k-$49.9k, “4” $50k-$74.9k, “5” $75k-$99.9k, “6” $100k-$149.9k, and “7” >=$150k.
[b] Objectively measured and categorized with binary scale: “1” citywide mean or higher values and “0” lower value.
[c] Objectively measured and categorized with binary scale: “1” sample-basis mean of the city or higher values and “0” lower value.

5.5.2.3 Predictors of Perceived Neighborhood Livability and Interrelationships

In examining the interrelationships among walking for any purpose (i.e. walking for transportation or recreation), perceived safety, and livability, negative concordance regarding walkability (OR 0.234, p=0.023) and preference discordance regarding safety (OR 0.440, p=0.087) had significant influences on perceived livability at the 0.1 significance level. Both walking for any purpose (OR 1.848, p=0.016) and perceived neighborhood safety (OR 1.571, p<0.001), which were main explanatory variables in this analysis, had significant and positive influences on perceived safety. White (OR 4.494, p=0.001) residents who earned higher household income (OR 1.459, p=0.001) and lived at a distance from the downtown areas of cities (OR 4.194, p<0.001) were more likely to perceive higher neighborhood livability. Employed (OR 0.374, p=0.013) residents who considered housing affordability in residential choices (OR 0.413, p=0.040) and had a longer length of residence (OR 0.970, p=0.047) were less likely to have a perception of livability in their neighborhoods (Figure 21 and Table 64).

In predicting walking for any purpose, only preference discordance had an influence, which was significant at a 0.1 level (OR 0.560, p=0.083), among discordances and negative concordance. Overall perceived safety, which was measured with a 10-point scale, was an explanatory factor influencing walking for transportation or recreation (OR 1.162, p=0.026). Someone to walk with (OR 1.979, p=0.004), employment (OR 0.331, p<0.001), and a difficulty in walking (OR 0.313, p<0.001) were controlled as confounding factors. The parallel regression assumption could not be rejected (χ^2=6.55, p=0.256) (Long & Freese, 2001). When the overall perceived safety was predicted, safety discordance (B -0.568, p=0.016) and negative concordance (B -0.695, p=0.017) had influences at the 0.05 significance level. Preference discordance had a positive influence, but its significance was found at the 0.1 level (B=0.496, p=0.084). Walking for any purpose showed an influence on perceived safety (OR 0.333, p=0.013). Therefore, the analysis found reciprocal relationships between walking for any purpose and overall perception of neighborhood safety. Covariates such as education attainments (B 0.562, p=0.018), employment status (B 0.599, p=0.002), neighborhood attractiveness consideration (B 1.384, p<0.001), and a child in the household (B -0.752, p=0.034) were controlled (Figure 21 and Table 64).

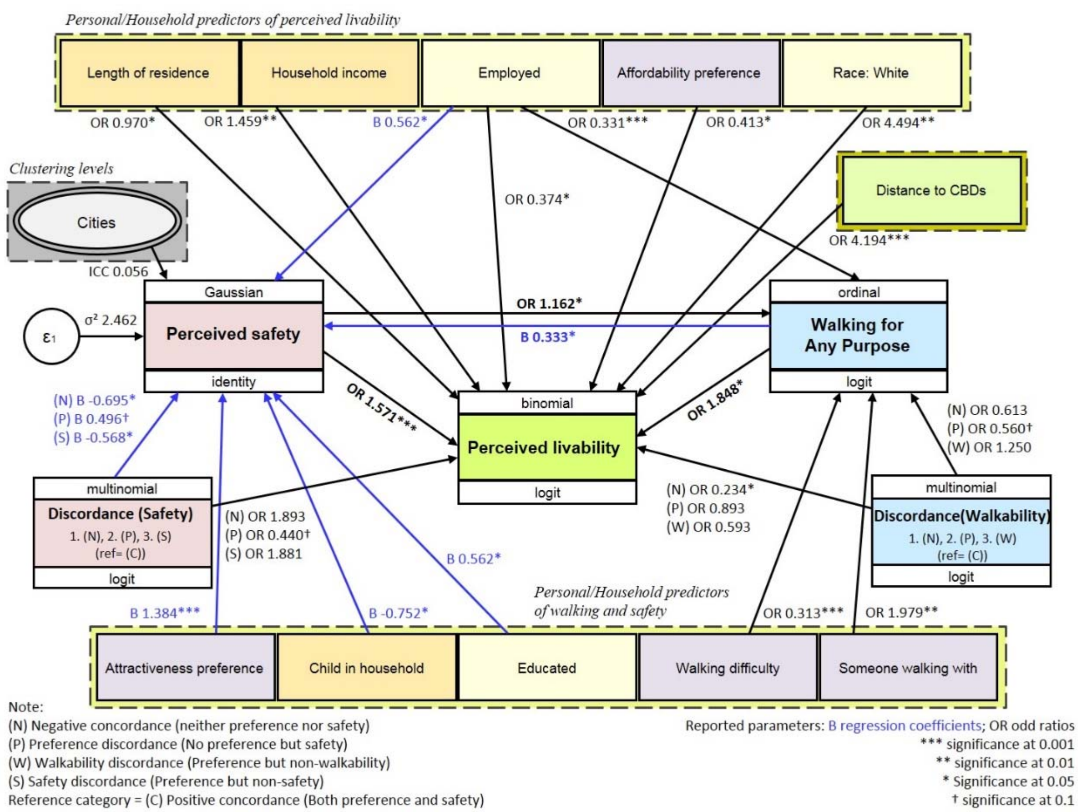

Figure 21 Diagram of Path Models Predicting Walking, Perceived Safety, and Livability

Table 64 Interrelationships among Neighborhood Discordance, Walking, and Perceived Safety, and Livability in the Urban Sample: Results from Path Models Using GSEM

Response variable ← Explanatory variables				
Perceived livability ←	OR	p-value	95% CI	
Race: non-Hispanic, White (ref= others)	4.494	0.001	1.824	11.073
Employment Status: for wages/self-employed (ref= unemployed)	0.374	0.013	0.172	0.815
Housing affordability consideration	0.413	0.040	0.178	0.958
Length of residence	0.970	0.047	0.941	1.000
Annual household income[a]	1.459	0.001	1.165	1.827
Network distance to CBDs[c]	4.194	0.000	1.934	9.095
Walk for transportation or recreation[b]	1.848	0.016	1.121	3.049
Overall perceived safety	1.571	0.000	1.285	1.920
Discordances and negative concordance (ref= positive concordance)				
- (N) Negative concordance	0.234	0.023	0.067	0.818
- (P) Preference discordance	0.893	0.829	0.320	2.491
- (S) Walkability discordance	0.593	0.465	0.146	2.410
Discordances and negative concordance: ref (positive concordance)				
- (N) Negative concordance	1.893	0.308	0.555	6.462
- (P) Preference discordance	0.440	0.087	0.172	1.125
- (S) Safety discordance	1.881	0.254	0.635	5.569
Walking for transportation or recreation[b] ←	OR	p-value	95% CI	
Employment Status: for wages/self-employed (ref= unemployed)	0.331	0.000	0.205	0.534
Any difficulty in walking (ref= no difficulty)	0.313	0.000	0.169	0.578
Someone to walk with (ref= no one)	1.979	0.004	1.247	3.142
Overall perceived safety	1.162	0.026	1.019	1.326
Discordances and negative concordance: ref= positive concordance				
- (N) Negative concordance	0.613	0.138	0.321	1.170
- (P) Preference discordance	0.560	0.083	0.291	1.079
- (S) Walkability discordance	1.250	0.578	0.569	2.749
Perceived safety ←	B	p-value	95% CI	
Education level: some college or higher (ref= lower than some college)	0.562	0.018	0.097	1.027
Employment Status: for wages/self-employed (ref= unemployed)	0.599	0.002	0.219	0.978
Attractiveness consideration	1.384	0.000	0.836	1.931
Walking for transportation or recreation[b]	0.333	0.013	0.071	0.595
The presence of children in household	-0.752	0.034	-1.449	-0.055
Discordances and negative concordance: ref= positive concordance				
- (N) Negative concordance	-0.695	0.017	-1.265	-0.125
- (P) Preference discordance	0.496	0.084	-0.067	1.059
- (S) Safety discordance	-0.568	0.016	-1.030	-0.106
Akaike information criterion (AIC)		1935.921		
Bayesian information criterion (BIC)		2064.487		
Intraclass correlation coefficient (ICC) of cities		0.056		

Parallel regression assumption (proportional odds assumption) test: χ^2=6.55 (p=0.256).

[a] Measured with a 7-point scale: "1" <\$25k, "2" \$25k-\$34.9k, "3" \$35k-\$49.9k, "4" \$50k-\$74.9k, "5" \$75k-\$99.9k, "6" \$100k-\$149.9k, and "7" ≥\$150k.

[b] Measured with a 3-point scale: "1" neither transportation nor recreational walking, "2" walking for 1-149 minutes for either purpose, "3" walking for 150+ minutes for either purpose or 1-149 minutes for both purposes.

[c] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

5.6 DISCUSSIONS

5.6.1 Neighborhood Consideration, Choice, and Discordance

In Chapter IV, results of analyses showed that a majority of proponents of neighborhood walkability considered neighborhood safety as well for their residential selection, while only a minority of proponents of neighborhood safety considered walkability in their residential choices. This implied that overall neighborhood safety and walking-related safety are not identical in terms of residential preference. Comparing objective walkability and safety of respondents' neighborhoods, 254 respondents resided in both walkable and safe neighborhoods (Table 41). The number is identical to 40.3% of the total respondents, 77.4% of the residents in walkable communities, and 75.1% of residents in safe communities. This suggested that many neighborhood choices for walkability or safety involved another attribute (i.e. walkability or safety) as well, even though neighborhood choices for both walkability and safety attributes were only 40% of the total respondents. The other 34.6% of residents lived in neighborhood environments that were neither walkable nor safe. Specifically, 92.7% of urban neighborhoods that were objectively evaluated as walkable were also assessed as safe. Unlike residential preference or neighborhood consideration, neighborhood choices for walkability and safety were closely incorporated in choices for one another.

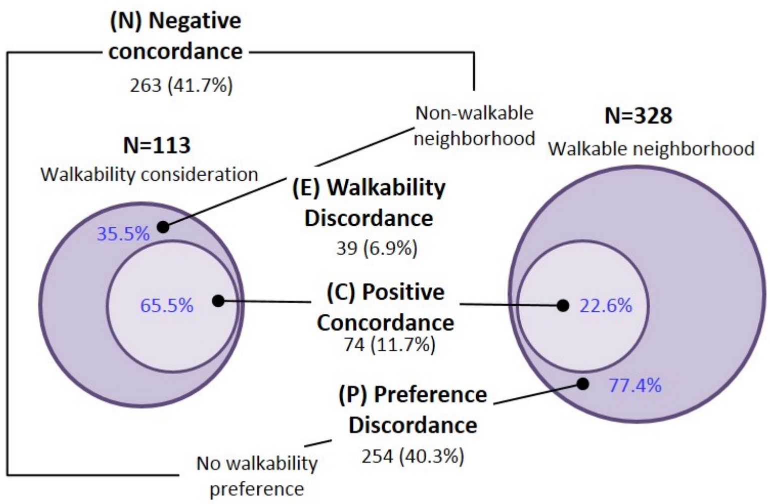

Figure 22 Conceptual Diagram of Walkability Concordance and Discordance

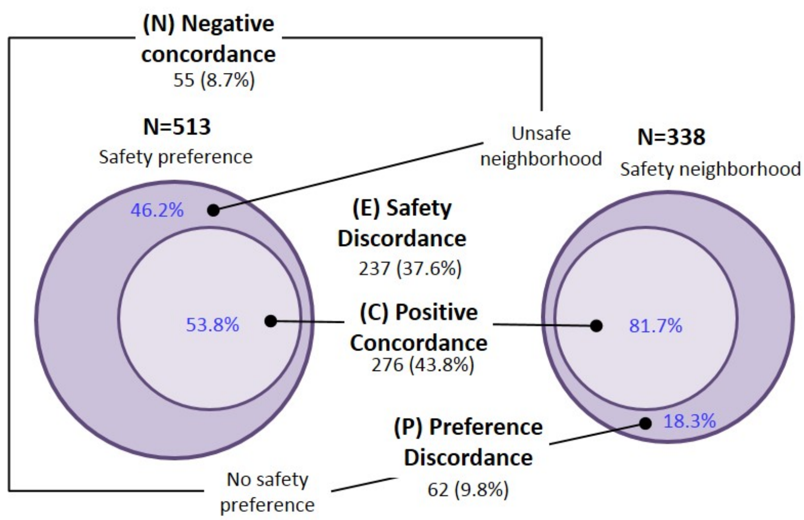

Figure 23 Conceptual Diagram of Safety Concordance and Discordance

Out of a total of 630 respondents, results showed that 74 (11.7%) residents considered walkability and lived in walkable neighborhoods, and 263 (41.7%) residents did not consider walkability and lived in non-walkable neighborhoods (Figure 22). It also showed that 55 (8.7%) residents did not consider safety and resided in unsafe neighborhoods, and 276 (43.8%) residents considered and resided in safe neighborhoods

(Figure 23). Thus, the rate of total concordance (both positive and negative) between neighborhood considerations and choices for walkability was 53.5%, while 52.5% was for safety. However, considering the significantly lower level of perceived livability among the negative concordance group compared to the positive concordance group regarding walkability (OR 0.234, p=0.023) (Table 64), it is questionable that non-walkable neighborhoods are the preferred residential environments of the negative concordance group. It is not conclusive that non-consideration of walkability implied the preference for non-walkable neighborhoods (Handy et al., 2008). Therefore, the concepts of neighborhood concordance should be distinguished between positive concordance (having a walkability preference and living in walkable neighborhoods) and negative concordance (having no walkability preference and living in non-walkable neighborhoods) in studies addressing the matching of residential preference and neighborhood quality (Schwanen & Mokhtarian, 2003, 2007).

In addition, the matching rates between neighborhood considerations and choices should be calculated based on those who considered walkability or safety because we have no information on preference for those who reported neither walkability nor safety consideration (Arvidsson et al., 2012). The rate of positive concordance among the proponents of walkability was 65.5%, while it was 53.8% among the proponents of safety. This implies that 65.5% of residents who selected their current residential locations considering neighborhood walkability lived in neighborhoods at the actual level of walkability (Figure 22). The rates are similar to the two-thirds of respondents who correctly perceived their walkable neighborhoods which were objectively evaluated according to a previous study (Gebel et al., 2009). The rates of concordance were higher than the poor to moderate matching rates reported from previous studies examining concordance between objective and perceived walkability (Bailey et al., 2014), but lower than the agreements (ranging 70–80 %) between current neighborhood types and stated residential preferences (Schwanen & Mokhtarian, 2005b).

Among the preference discordance, walkability discordance, and positive concordance groups (*interesting groups*), except for the negative concordance group not directly related to the role of neighborhood discordance, about 80% of residents belonged to the preference discordance or walkability discordance group. Regarding safety, 52% of residents belonged to the preference discordance or safety discordance group. The rate of residents with preference discordance who lived in safe areas but did not consider safety was higher among urban residents (17.7% among urban residents vs. 3.0% among rural residents), while the rate of residents with safety discordance who considered safety but lived in unsafe areas was higher among rural residents (48.2% among rural residents vs. 25.5% among urban residents) (Table 42). This may be related to a result from other analyses showing that more urban residents lived in safe residential areas than did rural residents (Table 41). Even though the mean value of the NSI was higher in rural towns (mean 1.33 in rural towns vs. 1.15 in urban towns), it alludes to the fact that more rural residents lived in unsafe neighborhoods (Table 40).

5.6.2 Correlates of Neighborhood Discordance

Analyses were conducted to answer two research questions, "Who lived with neighborhood discordances although they paid for neighborhood walkability or safety in their housing purchases?” and “What environmental factors were involved in the neighborhoods where those with neighborhood discordances chose to live?” Bivariate and multivariate analyses were executed to explore and identify such personal and environmental correlates of neighborhood discordances. The analyses were done with the total sample and four subsamples. This section discusses results focusing on neighborhood discordances and their personal and environmental correlates. Further discussions are completed in the next section including direct and indirect relationships with walking and safety perceptions (section 5.6.3). This section denotes sample or subsamples by initials when describing corresponding relationships because of the complexity in discussing results from those analyses. That is, (T) refers to the total sample, (U) for the urban subsample, (R) for the rural subsample, (O) for the older adult subsample, and (M) for the middle-aged subsample.

5.6.2.1 Correlates of Preference Discordance

Regarding neighborhood walkability, multivariate analyses using GSEM identified five personal demographic factors, two attitudinal or activity factors, and five environmental factors as correlates of the odds of belonging to the preference discordance group across the sample and subsamples (Table 65). Age (O), White (T, U, R, M), obese residents (O), residents having more developments after moving into a neighborhood (M), and living at a distance from CBDs (U), were more likely to belong to the preference discordance group, while Hispanic (O), married residents (R), and residents who considered safety for their residential selection were less likely to belong to the preference discordance group. As environmental correlates, perceiving safety for walking (T, U) was only a positive correlate of preference discordance, while crosswalks (T, R, O, M), greenery (U), and employment density (T, O) were natively associated with belonging to the preference discordance group. In predicting the odds of preference discordance in relation to neighborhood safety, one personal demographic, four attitudinal and activity, one household, and two environmental correlates were found (Table 65). Hispanic (T, M) residents and those who had lived at their current residence for a longer duration (O) were more likely to live with preference discordance, while residents who had a housing affordability consideration (U), an attractiveness consideration (T, U, R, O, M), more screen or sitting hours per week (R), utilitarian walking, and green/vacant spaces in neighborhoods (T, R, O, M) were less likely to live with preference discordance.

Even older residents among older adults were more likely to live with preference discordance (Table 65). This infers that the oldest-old adults had a tendency to disfavor living in walkable neighborhoods because of their immobility, but their neighborhood environments were actually evaluated as walkable (Blazer, 2000). In addition, an additional test found that age was significantly correlated with a lower level of household income ($r= -0.109$, $p=0.046$). As another health issue among older adults, results showed obesity was the strongest factor to predict preference discordance. Obese older adults were 23.9 times more likely to live in walkable communities without a preference for walkability. This indicates how seriously attitudinal factors impacted the health status of individuals, such as obesity, even though they possessed sufficiently walkable residential environments (Frank et al., 2004; Saelens et al., 2012). With regard to race and ethnicity, Hispanic older adults were apt to have a preference for walkability and chose actual venues for their preferred lifestyle, while Hispanic residents from the middle-aged sample and the total sample were prone to disregard safety but actually lived in safe residential areas. A trend also showed that White residents chose walkable communities in spite of no consideration for walkability across all samples, except for the older adult subsample. This may result from many Hispanic older adults who lived in walkable residential environments where they wanted to live (Freeman et al., 2013). A previous study found that unmarried people among the general public had a greater tendency to support developments of walking-oriented communities (Handy et al., 2008). However, in the present study, married residents were shown to have a higher preference for walkability compared to unmarried residents living in walkable areas in rural towns.

In term of attitudes toward neighborhood environments and activities, results confirmed that consideration for safety was one of the most relevant factors to the consideration for walkability but safety consideration was independent of walkability consideration, corresponding to discussions on preferences for walkability and safety addressed in the section 5.6.1. Attractiveness consideration (T, U, R, O, M) and walking for transportation (T, R, O, M) were found to be negative and the strongest predictors of preference discordance across the sample and subsamples. Because this group signified no preference among residents for safe neighborhoods, it is reasonable to assume that these residents who neither traveled by walking nor regarded attractive neighborhood environments were not interested in the safety of their neighborhoods (Giles-Corti &

Donovan, 2002). Housing affordability consideration was related to preference for walkability (M) and safety (U) among residents in walkable or safe communities. This suggests that both neighborhood walkability and safety were prioritized in residential choices by those who were at a low household income level in urban residents and middle-aged group populations (Frank et al., 2007).

A positive relationship between the distance from CBDs and preference discordance (U) showed that some of the residents who had no preference for walkability lived in walkable communities somewhat remote to a city center in urban towns. Previous studies have examined local accessibility to neighborhood destinations in capturing associations between the built environment and walking behaviors (Cerin, Leslie, du Toit, Owen, & Frank, 2007; McCormack, Giles-Corti, & Bulsara, 2008; Moudon et al., 2007). This finding of the current study implies that residential choices for walkability can have different environmental characteristics along with regional locations (Boarnet, Greenwald, & McMillan, 2008; Cervero & Radisch, 1996). Both the length of residence (T, O) and more environmental changes since moving into neighborhoods (M) were associated with the odds of belonging to the preference discordance group for walkability or safety. The results propose a finding that the neighborhood attributes of walkability and safety were accepted as more important issues to new comers to the walkable and safe neighborhoods (Myers & Gearin, 2001).

Even though GSEMs were estimated to explore correlates of no preference among residents in same conditions living in walkable communities, perceived and objectively measured environmental correlates were identified from the results. The environmental correlates of preference discordance included the perception of low safety from traffic, high safety for walking, fewer crosswalks, fewer green or vacant spaces, and lower density of employment. These findings may be derived from environmental characteristics self-selected by the preference discordance group because of their lack of preference for traveling by other modes than walking (Cervero & Duncan, 2002). Further discussions dealing with walking behaviors are in the next section (section 5.6.3). For safety, environmental correlates of preference discordance included fewer greenery and higher employment density which were inferred as environmental characteristics self-selected due to their lack of preference for safety (Table 65).

Table 65 Multivariate Relationships between Preference Discordance and Personal/ Environmental Factors: A Summary Table

Domains and variables	Walkability					Safety				
	T	U	R	O	M	T	U	R	O	M
Personal – demographics										
Age: ranging 50 – 92 years				+						
Hispanic, Latino or Spanish origin (ref= others)				-		+				+
Race: non-Hispanic, White (ref= others)	+	+	+		+					
Obese: BMI>=30 (ref= non-obese (BMI<30))				+						
Marital status: Married (ref= unmarried)			-							
Employment Status: for wages/self-employed (ref= unemployed)										+*
Personal – attitudes and activities										
Housing affordability consideration					-		-			
Attractiveness consideration						-	-	-	-	-
Safety consideration	-				-					
Screen/sitting hours per week								+		
Walking for transportation per week: 1+ min. (ref: 0 min.)						-	-*	-	-	-
Household factors and regional locations										
Length of residence						+			+	
The % of parcel areas developed after moving in					+					
Network distance to CBDs		+								
Self-reported perceived safety										
Perceived safety related to traffic	-	-								
Perceived safety related to walking	+	+								
Objectively measured environments										
Number of crosswalks	-		-	-	-					
Mean of NDVIs		-					-		-	-
Density of employees in large businesses	-			-		+				

T-total sample, U-urban subsample, R-rural subsample, O-older adult subsample, M-middle-aged subsample, + associated positively, - associated negatively at a significance level of 0.05, and * significant at a 0.1 level.

5.6.2.2 Correlates of Walkability/Safety Discordance

Multivariate models found one personal demographic factor, two attitudinal or activity factors, three household or regional location factors, and eight objectively measured environmental factors correlated with walkability discordance in the total sample and subsamples (Table 66). Physical activity at work places (T, R, O, M), regional home locations (R), and violent crimes (T, U, M) were positive correlates of walkability discordance, while a college degree (T, R, O), the number of vehicles per person (U, O, M), residential location (R), crosswalks (T, R, O, M), intersection density (T, R, O), sidewalk completeness (T, R, M), neighborhood destinations (R, M), and employment density (T, O) were negative correlates of walkability discordance. Predictors of safety discordance included five personal demographic factors, two attitudinal or activity factors, three household or regional location factors, and six objectively measured environmental factors across the sample and subsamples. White (U), married residents (U, M), neighborhood attractiveness consideration (T, R, O), length of residence (R, O), distance to CBDs (R, O), intersection density (T, U, O, M), violent crimes (T, O, M), sex offenders (R), and pedestrian crashes (R) were positive predictors of safety discordance, while male (M), educated residents (O), age (T, R, O), someone to walk with (U), number of vehicles (R, O), crosswalks (T, O, M), and employment density (T, U, R, O) were negative predictors of safety discordance.

Education attainments lower than a college degree were only a personal demographic predictor of walkability discordance (T, R, O). This showed that the educational level was an important SES factor enforcing neighborhood choices unmatched with neighborhood preference (Morrow-Jones et al., 2004). White (U), female (T), married (U), and middle-aged (T, R, O) residents were personal characteristics of the safety discordance group. In spite of a higher preference for safety than their counterparts (e.g. unmarried, older adults), their residential choices were unsafe neighborhoods. Even if considering the NSI conceptualized and developed with walking-related safety items, their residential choices involved much higher crime/crash risks. Therefore, the unmatched choices of those with higher preferences can be inferred as cognitive mismatches between perception and actual environments of neighborhoods (Handal et al., 1981).

Urban workers engaging in a higher level of physical activity was a predictor of belonging to the walkability discordance group. This seems to be derived from their low SES (Frank et al., 2007). Results confirmed that proponents of housing affordability were more likely to prioritize walkability as well as actually lived in walkable communities than both preference and walkability discordance groups. Attractiveness consideration was closely related to safety consideration (r_{φ}= 0.385, $p<0.001$). However, results showed that attractiveness preference was positively related to safety discordance (T, R, O). This meant that a high preference for attractiveness was associated with a low level of objectively evaluated safety among proponents of safe neighborhoods (r_{φ}= -0.104, p=0.009). Since this study employed a limited number of objective measures for neighborhood attractiveness and amenity items, it is not possible to capture relationships between objective measures of attractiveness and safety in this study. Although attractiveness consideration was certainly accompanied by safety consideration, it was presumed that objective measures of these characteristics were traded off against one another in a residential choice process (Bhat & Guo, 2004). Results found that social interaction was also attributed to residential choices for safety (Hur & Morrow-Jones, 2008).

Notably, a remote home location in a region presented mixed relationships with walkability discordance, associated positively in the urban subsample, and negatively in the rural subsample. In urban towns, home location in proximity to CBDs represented a collection of walkability features near activity centers, which were presumed to be compact development patterns, mixed land uses, direct street connections, and well-maintained pedestrian infrastructures (Ewing & Cervero, 2001, 2010). In rural towns, walking-oriented environmental variations from a large activity center were explained by crosswalk, sidewalk, and intersection density variables in the estimated model. In addition, small activity centers in the middle of nowhere might provide venues allowing a modest level of walkability at least (Ewing & Cervero, 2010). Residents who had more vehicles were less likely to belong to the walkability discordance group (U, O, M). According to some previous studies, a low level of car ownership has been believed to constrain choosing home locations to afford access to transit service or by other non-motorized modes (Bhat & Guo, 2007; Cervero & Duncan, 2002). The results of the present study suggest that higher levels of auto ownership represent a certain lifestyle preference including a preference for walkability and higher levels of income rather than auto dependency (Bagley & Mokhtarian, 1999). For safety, the higher levels of auto ownership enabled residents to choose remote home locations to find safer residential sites (R, O) (Cervero & Duncan, 2002). Long-term residents were a common predictor of both walkability and safety discordances. They were more likely to live in neither walkable nor safe areas despite their preference for both walkability and safety. Although the long-term residents also attempted to consider walkability and safety, there is a higher probability of residents who recently moved to homes to seek more qualified communities in term of the attributes (Lu, 1999).

Across the total sample and subsamples, neighborhood environments of the walkability discordance group were characterized as fewer pedestrian infrastructures, local destinations, higher crime rates, and lower street connectivity and employment density. The characteristics described neighborhood environments which were not walking-oriented and were chosen by some of the walkability proponents. This confirmed that the environments with discordance were the opposite of a common definition of walkable neighborhoods which included compact development, mixed land uses, and direct street connections (Saelens & Handy, 2008). Unsafe neighborhood environments chosen by some of the proponents of safety included fewer crosswalks, direct street connection, higher crime and crash rates, and lower employment density. The results confirmed that supplying pedestrian infrastructures, especially crosswalks, was effective in improving the objective evaluation of safety in communities (Foster & Giles-Corti, 2008). Dense and direct street configurations, which were important to increase walkability, were evaluated as inadequate to foster safe environments. More large businesses with greater than 100 employees in neighborhoods were identified as a characteristic of both walkable and safe communities which were self-selected by those with preferences. Higher employment density, which has been believed as a strong predictor of walking travels, also represented a diversity of mixed land uses (Ewing & Cervero, 2001, 2010). Results also proposed that walkable-oriented environments around large businesses (e.g. department stores, universities, governments) fulfilled the conditions in relation to safety (Dawson et al., 2007).

Table 66 Multivariate Relationships between Walkability/Safety Discordance and Personal/ Environmental Factors: A Summary Table

Domains and variables	Walkability					Safety				
	T	U	R	O	M	T	U	R	O	M
Personal – demographics										
Gender: Male (ref= female)										-
Age: ranging 50 – 92 years						-		-	-	
Race: non-Hispanic, White (ref= others)							+			
Marital status: Married (ref= unmarried)							+			+
Education level: some college or higher (ref= lower than some college)	-		-	-					-	
Personal – attitudes and activities										
Housing affordability consideration					-					
Attractiveness consideration						+		+	+	
Someone to walk with (ref= no one)							-			
PA at work: standing/walking/heavy labor (ref= no work/sitting)		+								
Household factors and regional locations										
Length of residence (imputed)	+		+	+	+	+		+	+	
The number of vehicles per person		-		-	-			-	-	
Network distance to CBDs		+	-					+	+	
Objectively measured environments										
The number of crosswalks	-		-	-	-	-			-	-
Intersection density	-		-	-		+	+		+	+
Sidewalk completeness	-		-		-					
Density of violent crime	+	+			+	+			+	+
Density of sex offenders								+		
Density of pedestrian/cyclist crashes								+		
Number of destinations		-			-					
Density of employees in large businesses	-			-		-	-	-	-	

T-total sample, U-urban subsample, R-rural subsample, O-older adult subsample, M-middle-aged subsample, + associated positively, - associated negatively at a significance level of 0.05, and * significant at a 0.1 level.

5.6.2.3 Correlates of Negative Concordance

Personal and environmental correlates of negative concordance were also identified (Table 67). Correlates of negative concordance in terms of walkability included four personal demographic variables, one attitudinal variable, two household or regional location variables, two perceived safety variables, and seven environmental variables captured from objective data. White (T, U, M), obese residents (O), distance to CBDs (U), safety for walking (R), sex offenders (R), and pedestrian crashes (T, U, O) were positively related to the odds of belonging to the negative concordance group, while Hispanic (R, O), educated residents (O), safety consideration (T, R, M), distance to CBDs (R), perception of safety from traffic (T, R), crosswalks (T, R, O, M), intersection density (R), sidewalk completeness (T, R, O, M), destinations (T, U, O, M), and employment density (T, U, R, O, M) were negatively associated with negative concordance. Two personal demographic factors, three personal attitude and activity factors, one household factor, and four objective environmental factors were identified as correlates of negative concordance regarding safety. Male residents (R), length of residence (T, U, R, O), intersection density (T, U, O, M), and violent crimes (T, O, M) were positively related to negative concordance, while age (T, O), attractiveness consideration (R, O), walking for transportation (T, R, M), density of housing (T, U, M), and density of employment (T, U, O, M) were negative correlates of negative concordance.

Table 67 Multivariate Relationships between Negative Concordance and Personal/ Environmental Factors: A Summary Table

Domains and variables	Walkability					Safety				
	T	U	R	O	M	T	U	R	O	M
Personal – demographics										
Gender: Male (ref= female)								+		
Age: ranging 50 – 92 years						-			-	
Hispanic, Latino or Spanish origin (ref= others)			-	-						
Race: non-Hispanic, White (ref= others)	+	+			+					
Obese: BMI>=30 (ref= non-obese (BMI<30))				+						
Education level: some college or higher (ref= lower than some college)				-						
Personal – attitudes and activities										
Attractiveness consideration								-	-	
Safety consideration	-		-		-					
Walking for transportation per week: 1+ min. (ref: 0 min.)						-		-		-
Household factors and regional locations										
Length of residence					+	+	+	+	+	
Network distance to CBDs		+	-							
Self-reported perceived safety										
Perceived safety related to traffic	-		-							
Perceived safety related to walking			+							
Objectively measured environments										
The number of crosswalks	-		-	-	-					
Intersection density			-			+	+		+	+
Sidewalk completeness	-		-	-	-					
Density of violent crimes						+		+*	+	+
Density of sex offenders			+							
Density of pedestrian/cyclist crashes	+	+		+						
Total number of destinations	-	-		-	-					
Density of housing units						-	-			-
Density of employees in large businesses	-	-	-	-	-	-	-		-	-

T-total sample, U-urban subsample, R-rural subsample, O-older adult subsample, M-middle-aged subsample, + associated positively, - associated negatively at a significance level of 0.05, and * significant at a 0.1 level.

This negative concordance group was probably composed of non-Hispanic White residents (T, U, M) or residents who disregarded walkability, safety (T, R, M), and attractiveness (T, R, M) for their residential selections. This group showed a tendency to live for many years at current residences and had a low level of utilitarian walking. This group also confirmed that regional home locations remote from downtowns were positive predictors of negative concordance in urban towns, while they were negative predictors in rural towns with regard to walkability (Ewing & Cervero, 2001). Concerning walkability, neighborhoods where the negative concordance group lived contained characteristics of non-walkable neighborhoods such as poor pedestrian infrastructures, low accessibility to destinations, indirect street connectivity, low density, and higher crash rates. Regarding safety, negative concordance was related to low density, direct street connectivity, and high crime rates. Unlike the safety discordance group, no difference was found in pedestrian infrastructures and crash rates between the negative concordance group and the positive concordance group. Thus, the neighborhoods of the negative concordance group were likely to have fewer risk factors in terms of neighborhood safety compared to the safety discordance group (Talen, 2001).

5.6.3 Predictors of Utilitarian Walking and Perceived Safety

Using mixed-effect models and GSEMs, multivariate analyses were conducted to examine influences of preference discordance, walkability/safety discordance, and negative concordance, compared to the positive concordance group as a reference group (Table 68). Preference discordance had negative influences on utilitarian walking across the total sample, rural and middle-aged subsamples, and walkability discordance also negatively influenced walking in the rural subsample. Safety perception was positively affected by preference discordance in the urban and older adult subsample, while negatively influenced by safety discordance in the total sample and urban subsample.

In addition to examining impacts of neighborhood discordance, the multivariate models also identified other predictors of utilitarian walking and perceived safety of the total sample, and urban, rural, older adult, and middle-aged adult subsamples. In predicting the odds of utilitarian walking, correlates were found including three personal demographic factors, two attitude and activity factors, two household and regional location factors, and two safety perception factors across all the sample and subsamples (Table 68). Male (T, U, M), employed residents (R), safety consideration (T), perceived safety from traffic (T, R, M), and safety from crime (U, O) were positive predictors of walking for transportation, while White residents (T, U), any difficulty in walking (T, R, O), household income (T, O, M), and homes not near CBDs (U) were negative predictors of walking. For safety, five personal demographic variables, two personal attitudes and activity variables, and three household variables were found as predictors of perception of overall neighborhood safety. Male (T, R, M), married (O), educated (U, O), employed (U, O, M) residents, age (O), attractiveness consideration (T, U, O, M), utilitarian walking (T, U, R, O), and household income (T, R) were positive predictors of perceived safety, while length of residence (U, O) and a child in the household (U) were negative predictors of safety (Table 68). Direct effects of objectively measured environmental factors on walking and safety were also examined through an analytical process with mixed-effect modeling and GSEM, but no significances were found in direct relationships due to the neighborhood discordance measures covering many of the environmental variations.

In the total sample, preference discordance played a greater role for utilitarian walking than walkability discordance (Table 68). The walkers for transportation were likely to be male, non-White residents, considered safety, earned a low income, and perceived higher safety from traffic. These were general characteristics of walkers. Even though the walkability discordance group were less educated and lived for a longer duration at their current residence, education and residential length did not belong to the general characteristics of walkers. A difference in the rates of walking between the positive concordance group and the walkability discordance group was less significant (p=0.053). Both preference discordance and negative concordance groups were more likely to be White residents and less likely to consider safety. Considering that the race and safety consideration were parts of the general characteristics of walkers, the racial and attitudinal factors regarding safety were strong predictors of discordances restricting the level of walking behaviors (Grieser et al., 2006). Although results found a low level of walking-oriented developments (i.e. fewer pedestrian infrastructures, indirect street connectivity, higher crime, low mixed land uses) were attributed to walkability discordance, their influences were not stronger than the racial and attitudinal factors in the total sample.

Utilitarian walkers in urban towns were regarded as residents who were male, non-White, had a detached residence, and had a higher perception of safety from crime from downtowns (Table 68). However, neighborhood discordance, negative concordance, and even walkability and preference among the *non-interesting group* had no influence on the walking of urban residents. Given the consideration of these consistent results, gender, racial, regional home location factors, and safety perception from crime were only determinants of travel behaviors for urban walkers (Hooker et al., 2005). The remote home location was related to household income ($r=0.245$, $p<0.001$) which used to be a predictor of walking and was replaced by the regional location factors in a process of GSEM. Thus, it can be analogized that the location factors represented some measured or unmeasured SES factors such as household income which were related to choices of other travel modes than walking (Boarnet & Sarmiento, 1998). In rural towns, both preference and walkability discordances had negative impacts on the odds of walking for transportation. The walkers in rural towns were characterized as employed, residents who had no difficulty in walking, and had a higher perception of safety from traffic.

In this rural resident subsample, no characteristics of discordance groups overlapped with those of the positive concordance group. Through the mediation effects of discordances, White residents, which were a positive predictor of preference discordance, showed an indirect and negative influence on walking, while married residents, a negative predictor of the discordance, indirectly and positively influenced walking. Educated residents and home location at a distance had positive impacts, while long-term residents had negative impacts indirectly through a walkability discordance mediator. Even though negative environmental predictors of the walkability discordance group (e.g. pedestrian infrastructures, higher density, more destinations, fewer crimes) had positive effects on walking through walkability discordance, the relationships may be able to be conceptually defined as direct influences since walkability discordance was just a representative of collective non-walkable conditions, unlike the environmental factors self-selected by the preference discordance group (Litman, 2005).

Among older adults, no difficulty in walking, no child in the household, and perceived higher safety from crime were direct explanatory factors of utilitarian walking. Only preference discordance had an impact on their walking behaviors. Thus, Hispanic residents, more crosswalks, and higher employment density were positively related to walking, while even older and obese residents showed negative relationships with walking by the preference discordance mediation. Accordingly, predictors of walkability discordance did not have impacts on walking. In the middle-aged subsample, no significant relationships were found between discordances and walking. Middle-aged walkers were those who were male, at a lower income level, and perceived safety from traffic.

Safety discordance showed a stronger influence on perceived safety than preference discordance in the total sample (Figure 25). Preference discordance had a positive impact on the perception, but it was significant at the 0.1 level. Residents with a higher perception of safety were characterized as being male, considered attractiveness, walked for transportation, and earned a higher household income. Older residents, no attractiveness consideration, and shorter residential length were indirect explanatory factors of a higher perception of safety. Environmental features such as more crosswalks, lower crime rates, and higher employment density also impacted safety. Residential preference for neighborhood attractiveness and walking for transportation had direct and indirect impacts through negative concordance mediators (Giles-Corti & Donovan, 2002).

In urban towns, the perception of safety was attributed to both preference discordance and safety discordance, which were stronger predictors rather than negative concordance (Table 68). Unusually, preference discordance was a positive predictor of perceived safety. The characteristics of those with a higher safety perception included higher education level, employment, attractiveness consideration, utilitarian walkers, short-term residence, and no child in the household. Thus, predictors of preference discordance (e.g. Hispanic, affordability consideration) showed indirect relationships with safety perception. Attractiveness consideration possessed both direct and indirect influences on perceived safety. Non-White, unmarried residents, and those who had someone to walk with had indirect influences on a higher perception of safety. Indirect street connections and higher employment density were environmental factors influencing safety. For rural residents, influences of neighborhood discordances were not effective in perceiving higher neighborhood safety. Only male residents, walking for transportation, and higher household income were predictors of safety perception. Even through negative concordance, no effect of environments was found in this subsample. Therefore, personal and household sociodemographic factors and utilitarian walking were the only determinants of perception regarding neighborhood safety among rural residents (Bramston, Bruggerman, & Pretty, 2002).

In the older adults subsample, preference discordance was effective in predicting safety perception. Residents with higher perception were characterized as even older, married, educated, employed residents, those who considered attractiveness, walked for transportation, and had lived at their current residence for a short time. Of them, attractiveness consideration and utilitarian walking had both direct and indirect influences on safety perception. Low greenery was a self-selected environmental feature. Among middle-aged adults, no effects of discordances were found. Male, employed residents, and attractiveness consideration were positive predictors of safety. Mediating by negative concordance, utilitarian walking, indirect streets, high density, and low crime rates were related to an increase in the perception of safety.

Concerning residential self-section issues, analyses identified correlates of preference discordance (having no preference but living in walkable/safe neighborhoods), compared to positive discordance (having a preference but living in walkable/safe neighborhoods). Thus, the models were estimated to predict the odds of having “no preference” among residents who lived in walkable or safe neighborhoods. Nonetheless, neighborhoods where a preference discordance group resided consisted of certain characteristics including fewer crosswalks, fewer green or vacant spaces, or lower density of employment. The lack of preference for walkability among the preference discordance group itself discouraged walking behaviors. But, relatively lower walkable conditions of neighborhoods which were self-selected by the preference discordance group also discourage their walking (Bagley & Mokhtarian, 2002). This study also identified fewer green/vacant spaces as neighborhood conditions self-selected by the preference discordance group regarding safety, which rather increased the perception of neighborhood safety (Jorgensen & Anthopoulou, 2007).

Table 68 Predictors of Utilitarian Walking and Perceived Safety: A Summary Table

Domains and variables	Walking					Safety				
	T	U	R	O	M	T	U	R	O	M
Personal – demographics										
Gender: Male (ref= female)	+	+			+	+		+		+
Age: ranging 50 – 92 years									+	
Race: non-Hispanic, White (ref= others)	-	-								
Marital status: Married (ref= unmarried)									+	
Education level: some college or higher (ref= lower than some college)							+		+	
Employment Status: for wages/self-employed (ref= unemployed)			+				+		+	+
Personal – attitudes and activities										
Attractiveness consideration						+	+		+	+
Safety consideration	+									
Any difficulty in walking (ref= no difficulty)	-		-	-						
Screen/sitting hours per week					-*					
Walking for transportation per week: 1+ min. (ref: 0 min.)						+	+	+	+	
Household factors and regional locations										
Length of residence							-		-	
The presence of children in household							-			
Annual household income	-			-	-	+		+		
Network distance to CBDs		-								
Self-reported perceived safety										
Perceived safety related to traffic	+		+		+					
Perceived safety related to crime		+		+						
Discordances and negative concordance (ref= positive concordance)										
- (N) Negative concordance	-		-	-		-	-*	-		-
- (P) Preference discordance	-		-	-		+*	+		+	
- (W) Walkability discordance / (S) Safety discordance	-*		-			-	-			-*

T-total sample, U-urban subsample, R-rural subsample, O-older adult subsample, M-middle-aged subsample, + associated positively, - associated negatively at a significance level of 0.05, and * significant at a 0.1 level.

5.6.4 Interrelationships among Neighborhood Discordance, Walking, and Perceived Safety, and Livability

5.6.4.1 Neighborhood Consideration, Choice, Discordance, Utilitarian Walking, and Perceived Safety

In the previous section (section 5.6.3), the influences of neighborhood discordances and the predictors of utilitarian walking and safety perceptions were discussed comprehensively, including direct and indirect relationships. This section takes more of a focus on the interrelationships among main constructs of the study: neighborhood consideration, choice, discordance, walking, and perceived safety.

Both preference discordance and walkability discordance negatively influenced walking for transportation among the rural subsample, while only the preference discordance negatively influenced walking among the total sample and older adult subsample (Figure 24). Discordances did not play any significant role for walking among the urban and middle-aged subsamples. In addition to discussions on predictors of walking in the previous section (section 5.6.3), the different roles of neighborhood discordances on walking between urban towns and rural towns may also be derived from a small prevalence of walking for transportation in urban towns. Only 16% of urban residents were utilitarian walkers, while 61.3% of rural residents walked for utilitarian purposes. For middle-aged adults, other personal or household factors such as gender, household income, and safety perception from traffic may be strongly related to discordances and directly influenced their behaviors, so that discordances in preference or walkability did not play a role as barriers to walking (Cerin, Leslie, & Owen, 2009).

Even though the neighborhood discordance measures covered environmental variations, perceptions of safety related to traffic, crime, and walking still had direct or indirect effects on walking for transportation (Figure 24). This finding implies that the effects of safety perception were at least partially independent of actual safety conditions (Piro et al., 2006). Safety perception from crime directly influenced walking of urban and older residents, while objectively measured violent crimes had indirect influences on walking through the mediation of walkability discordance in the total sample, and urban, and middle-aged subsamples. Perceived safety from traffic directly encouraged utilitarian walking among the total sample, and rural, and middle-aged subsamples. In addition, traffic-related safety perceptions also had indirect influences through mediating by preference discordance (T) and negative concordance (T, R). An objective measure of pedestrian crashes was mediated by negative concordance. Perception of safety for walking had no direct impact on walking behavior, but indirect effects of safety for walking were found through preference discordance (T) and negative concordance mediation (R).

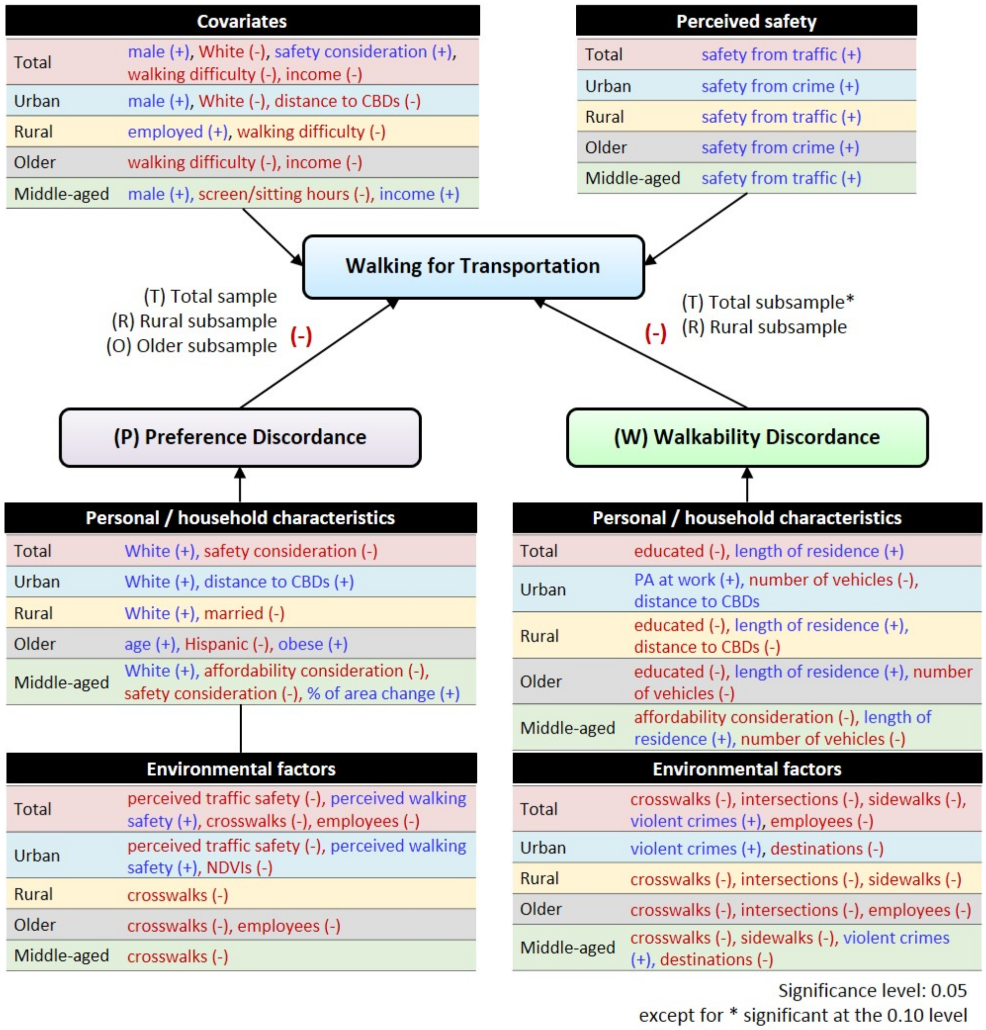

Figure 24 A Summary Diagram of the Interrelationships among Neighborhood Discordances, and Utilitarian Walking

For safety, safety discordance negatively impacted overall perceived safety among the total sample and urban subsample (Figure 25). However, preference discordance positively impacted the perception of overall safety among the urban and older adult subsample. It may be due to the possibility that residents who did not have a safety preference may not have high expectations for the actual safety conditions, leading to high levels of perceived safety given similar objective conditions (Ross, 2000). Discordances were not shown significant for perceived safety among the rural and middle-aged subsamples, although statistical differences in the levels of safety perception between urban and rural residents and between older adults and middle-aged adults were not found. For rural residents perceiving a higher safety, gender, utilitarian walking, and household income were the most important, while gender, employment status, and neighborhood attractiveness were more important than other factors to perceived safety among the middle-aged adults (King et al., 2000).

This study also examined effects of walking for both utilitarian purposes and recreational purposes on the overall perception of safety (Figure 25). Utilitarian walking had direct impacts on safety across the total sample, and urban, rural, older-adult subsamples. In addition, the utilitarian walking indirectly influenced the perception of safety mediated by preference discordance (O). Neither direct nor indirect effect of recreational walking was found through this bundle of multivariate analyses processes. In these reviews of influences on walking and safety perceptions, preference discordance had stronger mediating effects on both neighborhood walking and perception of safety than environmental discordance (walkability/safety). This implies that residential preference may involve many measured or unmeasured behavioral, social and perception factors. In practice, the survey questions were asked to capture neighborhood consideration involved inherent preferred lifestyles and initial perceptions of neighborhoods when they chose residential locations (Boone-Heinonen et al., 2011). The finding confirmed that examining mediating effects can provide additional knowledge to the existing literature by discovering indirect relationships inherent in direct relationships found from previous studies (Bohte, Maat, & van Wee, 2009).

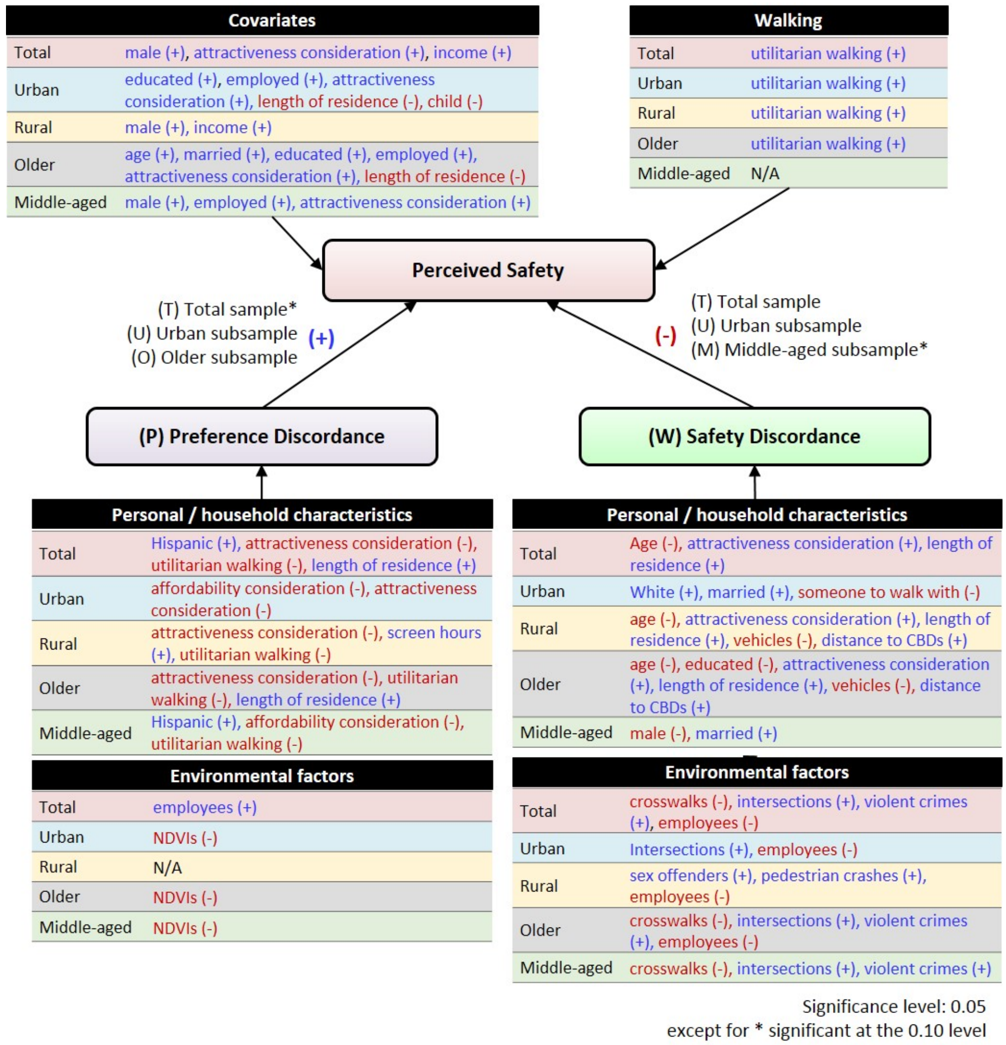

Figure 25 A Summary Diagram of the Interrelationships among Neighborhood Discordances and Perceived Safety

The discussed findings were derived from analyses examining proponents of walkability or safety or residents in walkable or safe communities (*interesting group*). Other stages of analyses were conducted to examine non-proponents of walkability and residents in non-walkable neighborhoods (*non-interesting group*), and the results are reported in Table 57. For the analyses, the preference discordance group and walkability/safety discordance group were compared to the negative concordance group. Combining those two stages of analyses, these results summarized that preferences for neighborhood walkability had an influence on walking in the total sample, and rural and older subsamples, while walkable neighborhood environments had an impact on walking in only rural towns among the interesting group (Table 69). However, there was no significant influence of preference or neighborhood environment on walking among the non-interesting group. This implies that either of walking-oriented neighborhood environments and positive attitudes toward non-motorized travels did not play any significant role in walking behaviors by itself (Cao et al., 2006; Handy et al., 2005, 2006). Considering a higher rate of walking prevalence among the positive concordance group compared to both preference and walkability discordance groups, this finding suggests the development of a comprehensive intervention to provide walking-friendly environments as well as improve personal attitudes to encourage walking travels (Cao et al., 2009; Handy, 2005).

Preference for neighborhood safety had an influence on perceived safety in the urban and older subsamples, while a safe neighborhood environment had an impact on the perception of safety in the total sample and urban subsample among the interesting group. Among the non-interesting group, safety consideration affected perceptions only in the rural subsample. Safe environments of neighborhoods influenced perceived safety in the total sample, and urban, rural, and middle-age subsamples. Unlike influences of preference for walkability and walkable environments on walking, preference for safety and safe neighborhood environments had impacts on safety perception among both the interesting group and non-interesting group. These results showed that residents can perceive higher safety from neighborhood environments only because of living in safe neighborhoods or having a preference for safety. Many previous studies have documented that higher perceived safety led to a higher level of walking for transportation, recreation, and any purpose (Cao et al., 2006; Hooker et al., 2005; Shigematsu et al., 2009). Even though increasing perceived neighborhood safety will be helpful for encouraging walking and physical activity, it should be accompanied with securing a surveillance of neighborhoods and decreasing neighborhood-level risks to increase actual neighborhood safety (Foster & Giles-Corti, 2008; Won et al., 2016). In this study, 37.6% of residents chose their current residences due to neighborhood safety but their neighborhoods were evaluated as unsafe.

Additional tests were conducted comparing the preference discordance group and environmental (walkability/safety) discordance group (Table 69). The results are related to a popular research question addressed in previous studies on the effects of residential self-selection on travel behaviors. The previous studies attempted to compare the relative strength of influences of built environments and attitudes toward travel behaviors (Cao, 2009; Frank et al., 2007). According to a review of studies on residential self-selection, eight out of ten studies which compared the relative strength of built environments and attitudes reported that the built environments were stronger in predicting travel behaviors, ranging from 52% to 90% of combined effects of environments and attitudes

(Cao et al., 2009). In the present study, no difference was found between the strength of influences of walkable neighborhood environments and the strength of walkability consideration. However, safe neighborhood environments had 84.9% higher impacts among the total sample and 114.8% higher among the urban subsample on perceived safety than safety consideration (Table 57).

Table 69 A Summary of Influences of Environments and Preferences on Utilitarian Walking and Safety

Influences	Walking					Safety				
	T	U	R	O	M	T	U	R	O	M
Among the interesting group										
Environment + preference: (C) vs. (N)	+		+	+		+	+*	+		+
Environment: (C) vs. (W)/(S)	+*		+			+	+			+*
Preference: (C) vs. (P)	+		+	+		-*	-		-	
Among the non- interesting group										
Environment: (P) vs. (N)						+	+	+	+*	+
Preference: (W)/(S) vs. (N)								+		+*
Environment vs. preference										
Environment vs. preference: (P) vs. (W)						+	+		+	

(N) Negative concordance: having no preference and living in non-walkable/unsafe neighborhoods.
(P) Preference discordance: having no preference but living in walkable/safe neighborhoods.
(W)/(S) Environment discordance: having a preference but living in non-walkable/unsafe neighborhoods.
(C) Positive concordance: having a preference and living in walkable/safe neighborhoods.
+ associated positively, - associated negatively at a significance level of 0.05, and * significant at a 0.1 level.

5.6.4.2 Neighborhood Discordance, Walking for Any Purpose, Perceived Safety, and Livability

Regarding neighborhood livability, another stage of multivariate analyses using GSEM identified predictors of perceived livability including demographic (2 factors), attitudinal (1), and household or home location (3) factors (Figure 26). Both walking for all purpose and overall perceived safety were also found to be predictors of livability. However, concerning neighborhood discordances, only negative concordance for utilitarian and recreational walkability was significant at the 0.05 level. And, preference discordance for perceived safety was significant at the 0.1 level. White residents, higher household income, walking for utilitarian or recreational walking, and a higher perception of safety were positive predictors of perceived livability, while employed residents, residential preference for housing affordability, and longer length of residence were negative predictors of livability. In predicting the odds of walking for any purpose, the analyses found three personal factors: employment status, walking difficulty, and someone to walk with. A social interaction factor (someone to walk with) was a positive predictor of walking, while employed residents and immobility were negative predictors of walking. A path model predicting perceived safety had the same structure of model except for the length of residence, which was insignificant in these structural models including the livability response variable, since the same measure of perceived safety and the same explanatory variables as those in previous analyses were used for modeling.

Both walking and perception of safety influenced the level of perceived livability, and walking and safety had reciprocal relationships between them. Using a randomized trial design, a study found that a neighborhood-based walking program was effective in increasing the level of life satisfaction of senior residents (Fisher & Li, 2004). Previous studies also discovered that higher levels of moderate or vigorous intensity of physical activity were associated with higher scores for health-related quality of life (HRQL) (Brown et al., 2003; Vuillemin et al., 2005; Wendel-Vos et al., 2004). A body of previous research has identified the positive influence of the perception of safety from traffic (Cao et al., 2006), safety from crime (Hooker et al., 2005), safety for walking (Ball et al., 2007) on walking for transportation, recreation, and any purpose. Notwithstanding a large number of studies examining the influence of safety perception on walking (Foster & Giles-Corti, 2008; Van Cauwenberg et al., 2011), there is a plausible relationship where more pedestrians provide benefits by increasing the surveillance of streets and walking leads to increased perceived safety through more chances to be aware of the conditions under surveillance (Jacobs, 1961). However, this hypothetical and contraflow relationship is still less evident from existing literature (Foster & Giles-Corti, 2008).

Indirect relationships between personal/environmental factors and perceived livability were feasible through a negative concordance for walkability, walking for any purpose, and perceived safety. White, employed residents, household income, and length of residence were found as factors which had both direct and indirect influences on the perception of livability. Short-term residents showed higher levels of perceptions of safety as well as livability directly and indirectly. The duration of residence has been found to have inconsistent relationships with neighborhood satisfaction (Adams, 1992; Lu, 1999; Mohan & Twigg, 2007; Parkes, Kearns, & Atkinson, 2002). The length of residence was found to be positively related to neighborhood satisfaction from many previous studies (e.g. Adams (1992)). However, empirical results in examining this factor were often not consistently found in different studies (Lu, 1999; Mohan & Twigg, 2007). Given that there was little choice to move due to economic reasons, the extent of dissatisfaction with current residences can increase with a longer length of residence

(Mohan & Twigg, 2007). A recent moving experience also might elevate the satisfaction of residential choices (Lu, 1999).

A racial factor and the employment status of residents presented mixed relationships with perceived livability between direct and indirect influences. Examining White residents provided a positive influence on livability perception which was consistent with previous studies (Mohan & Twigg, 2007). Indirect relationships showed that White residents were less likely to walk for transportation, but neighborhood walking positively influenced perceiving livability. Although employed residents were a positive predictor of perceived safety which positively impacted livability, the employment factor directly and negatively influenced the perception of livability. The household income variable provided more mixed results. The results included direct and indirect positive influences through safety perception as well as indirect negative relationships through walking (Baba & Austin, 1989). These imply that neighborhood walking and walkable environments definitely can be prerequisites for life satisfaction, and many other personal predictors (e.g. age, income, education, marital status) were directly and differently associated with neighborhood satisfaction (Galster & Hesser, 1981). In addition, perceptions of safety and livability can be different along personal traits and life histories, although those two kinds of perceptions were highly related (Kahana, Lovegreen, Kahana, & Kahana, 2003).

Residents who lived in remote home locations from CBDs were more likely to perceive a higher livability. Even though previous studies have underscored the importance of local accessibility to work, business, and public services for neighborhood satisfaction (Basolo & Strong, 2002; Cook, 1988; Hur & Morrow-Jones, 2008), this study found that regional home locations also played an independent role for quality of life in non-metropolitan communities, showing regional distances far from city centers increased neighborhood livability. Local accessibility to destinations indirectly and positively influenced a higher perception of livability passing through negative concordance for walkability (Figure 12 and Table 59). The housing affordability consideration, which had a direct impact, confirmed the role of economic status on life satisfactions (Lovejoy et al., 2010; Mohan & Twigg, 2007; Parkes et al., 2002).

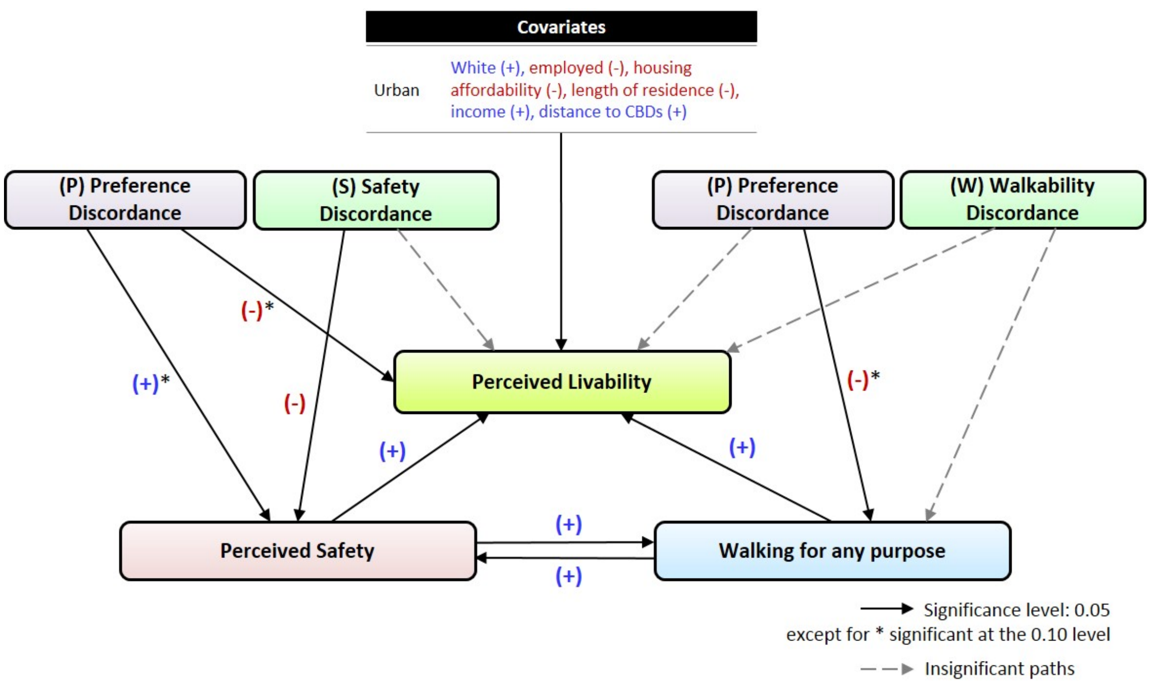

Figure 26 A Summary Diagram of the Interrelationships among Neighborhood Discordances, Walking, Perceived Safety, and Livability

5.6.5 Limitations

This study includes some limitations. This study utilized the datasets collected from two project survey methods. To alleviate potential problems in comparing and combining two different datasets, the sample frame of a dataset was adjusted to match another dataset which employed a random sampling method. The present study also attempted to adjust potential problems from the issue by performing analyses controlling for clustering level variations. This research has a cross-sectional design. Accordingly, this study will have a limitation in claiming some causal relationships (e.g. environment-discordance). The study was initiated to examine the effects of neighborhoods discordances between walkability preferences and neighborhood environments. In developing the research, neighborhood-level safety was considered and added as an important facet of walkability. Since objective measures of neighborhood-level safety were conceptualized and developed in terms of walking-related safety, the composite measures of safety may have a limitation in representing overall safety conditions at the community level. In this context, this study has a limitation in not capturing objective measures of walking-related safety such as fall risks and lightings. Future research should elaborate to conceptualize multi-faceted safety at the neighborhood level in objective evaluations. In dealing with an issue of life satisfaction at a community level, this study was not able to include many of the social-psychological factors such as community involvement, neighborhood attachment, and social cohesion which were unmeasured from one or two surveys used for the current study. Including those factors will enhance the persuasive powers in explaining relationships among community-level walkability, safety, and livability in future research. This study also has a limitation in developing a recreational walkability index. The developments of composite indices of objectively measured environmental factors involved a process to identify predictors of relevant outcomes (e.g. utilitarian walking, perceived safety). But, recreational walking was mainly attributable to personal and social interaction factors (e.g. someone to walk with, age, employment status). Other approaches are necessary to evaluate walkability at a neighborhood level regarding a recreational purpose and an overall aspect.

5.7 CONCLUSION

This dissertation study conducted a comprehensive examination of the links among neighborhood choices, neighborhood preferences, walking behaviors, perceived safety, and livability. On the way to the complete examination, this study developed a systematic measurement framework to evaluate neighborhood walkability and safety; and identified residents who lived in a condition called neighborhood discordance, defined as the mismatch between the preferred/expected and actual/current neighborhood environments. The current study also identified specific personal, household, and environmental traits associated with neighborhood discordances. The findings of the examinations are summarized here.

First, this study developed a systematic measurement framework to objectively evaluate neighborhood walkability and safety. The Utilitarian Walkability Index (UWI) compassed two major aspects regarding walking for transportation: a physical environmental aspect and a walking-related safety aspect. The physical environment for utilitarian walking was composed of four general dimensions: 1) density, 2) accessibility, 3) connectivity, and 4) pedestrian infrastructure. In sequence, 1) the density dimension was composed of residential density and employment density; 2) the accessibility dimension included the total number of all types of destinations (e.g. food stores, food services, service destinations); 3) the connectivity dimension was captured by intersection density; and 4) pedestrian infrastructure comprised sidewalk completeness and the number of crosswalks. The safety aspect which was titled Neighborhood Safety Index (NSI) also comprised four dimensions: 1) traffic-related safety, 2) crime-related safety, 3) pedestrian infrastructure, and 4) greenery. Through processes to adjust for community settings and town variations, weight factors with standardized coefficients predicting relevant outcomes, and split summed values at the means by cities, the two composite indices, UWI and NSI, were developed to capture aggregated attributes of neighborhood environments and to identify high quality and low quality communities in terms of walkability and safety.

Second, this study examined the relationships between neighborhood considerations and systematic evaluations of neighborhood level environmental quality. The investigations were performed to test a hypothesized relationship where neighborhood considerations influence neighborhood choice. This study found that walkability considerations significantly led to actual neighborhood choices, while safety considerations were not linked to residential choices for safe neighborhoods. Even though the results might be derived from unobserved factors in objectively evaluating community level safety, these may reflect a complexity in structuring perceptions of safety from many unknown relevant elements. The matching rates between neighborhood considerations and choices were 65.5% for walkability and 53.8% for safety (63.1% in the urban subsample). The rate for walkability is similar to a maximum rate reported from previous studies which matched perceptions and objective measures of walkable neighborhoods and indicated matching rates from poor to moderate. However, the rate of the current study is lower than the rates (ranging 70–80 %) found from studies which employed the stated preference measures to capture desirable neighborhood types. For further analyses, this study categorized the matching results between neighborhood considerations and choices into four groups: (C) positive concordance (who had a preference and lived in walkable/safe communities), (P) preference concordance (who had a preference but lived in non-walkable/unsafe communities), (W)/(S) walkability or safety discordance (who had no preference but lived in walkable/safe communities), and (N) negative concordance (who had no preference and lived in non-walkable/unsafe communities).

Third, this study identified residents who lived in a condition called neighborhood discordance, defined as the mismatch between the preferred/expected and actual/current neighborhood environments. Age, race/ethnicity, SES (e.g. education, the number of vehicles), the length of residence, and residential preference for neighborhood attractiveness were the most common personal or household predictors of neighborhood discordances across samples. Notably, higher levels of car ownership were a negative correlate of walkability discordance. The finding may imply that the higher levels of auto ownerships show a particular lifestyle involving walkability preference and higher

SES rather than auto dependency. Even though attractiveness consideration was a factor accompanied by safety consideration, the attractiveness preference was a positive predictor of safety discordance. The finding can presume that objective conditions of neighborhood safety and neighborhood attractiveness were traded off against one another in the process of residential choices. Regarding two sub-items of hypothesized relationships, this study confirmed that urban residents living with neighborhood discordance perceived lower levels of safety from traffic. They also belonged to environments with more violent crimes. Younger adults living with neighborhood discordance had a higher level of housing affordability preference, and older adults with neighborhood discordance were at a lower level of educational attainment.

Fourth, this study identified specific environmental factors associated with neighborhood discordances. For walkability discordance, walking-oriented environmental features such as higher employment density, more pedestrian infrastructures and destinations, direct streets, and fewer violent crimes were environmental correlates. For safety discordance, higher employment density, more pedestrian infrastructures, low crime and crash rates, and indirect street patterns were correlates. Interestingly, a home location remote from a city center played a role as discordance in urban towns, while it belonged to the positive concordance group in rural towns. Because environmental correlates among the rural subsample already explained variations of walking-oriented features at a city center location, small activity centers in the middle of nowhere might present a modest level of walkable spaces. As another interesting finding, this study showed that a difference in preference (preference vs. no preference) influenced choices of particular environmental features among residents living in neighborhoods with the same level of walkability. Residents with a preference for walkability self-selected neighborhood environments with more crosswalks, green spaces, and higher employment density, while those with no preference self-selected environments with low levels of those features. In this context, an interesting relationship was observed between the lack of preference and the perception of neighborhood safety. Because they had no preference for safety, some of the residents who lived in safe communities self-selected neighborhood environments with a low level of greenery, but he choice led to a higher perception of safety due to their expectation for actual safety conditions that were not much higher.

Fifth, this study examined influences of neighborhood consideration, choice, and discordance on walking behavior and safety perception, and their interrelationships. Both preference discordance and environmental discordance had significant influences on walking and perceived safety across the particular sample and subsamples. Both preference discordance and walkability discordance showed negative associations with utilitarian walking among the rural subsample, while only the preference discordance was found with a negative relation with walking among the total sample and older adult subsample. Among the urban and middle-aged subsamples, discordances had no significant role for walking. For safety, safety discordance was related to a lower perception of safety among the total sample and urban subsample. Remarkably, preference discordance was rather linked to a higher perception of safety among the urban and older subsample. It may be because residents who did not have a safety preference probably possessed high expectations for the real safety conditions, which led to higher perceived safety given similar objective conditions. Discordances did not show any significant role for safety perception among the rural and middle-aged subsamples. Utilitarian walking had a significant link to a higher safety perception both directly and indirectly, while recreational walking was shown to be not linked to safety perception either directly nor indirectly. This may be due to recreational walking mainly attributable to personal and social interaction factors (e.g. someone to walk with, age, employment status) rather than perceptions of safety. Although effects of object conditions of environments were identified by the effects of discordances, perceptions of neighborhood safety encompassing safety related to traffic, crime, and walking also possessed a direct or indirect influence on utilitarian walking. This implies that safety perception has influences on walking at least partially independent of actual safety conditions.

Walkability preference and neighborhood environment (walkability and safety) presented significant impacts on utilitarian walking among residents living in walkable communities or residents who had preferences. However, among those living in non-walkable neighborhoods or having no preference, neither neighborhood preference nor neighborhood walkability influenced the walking of residents. Safety preference and neighborhood safety showed significant influences on perceived safety regardless of residents living in walkable/non-walkable communities or having a preference/no preference. Therefore, comprehensive interventions for supportive environments and improved attitudes should be instituted to promote and encourage neighborhood walking. In addition, even though the perception of neighborhood safety can be improved by more secured environments or enhanced attitudes toward safety, it should encompass surveillances of neighborhoods and preventions of other potential risks at community levels in order to increase actual neighborhood safety, and further encourage physical activities and neighborhood walking. This study also compared the strengths of influences of preference and environmental factors on walking and perceived safety. The present study found no difference between the strength of walkability consideration and neighborhood environments influencing walking. But, safe environments at neighborhood levels showed 84.9% higher influences among the total sample and 114.8% higher among the urban subsample on perceived safety than safety consideration.

Sixth, the current study explored the interrelationships among neighborhood discordance, walking for any purpose, perceived safety, and livability. Both walking and perception of safety positively influenced a higher level of perceived livability, and the walking and safety indicated reciprocal relationships between each other. With respect to neighborhood discordances, only a negative concordance for utilitarian and recreational walking had a direct relationship with perceived livability at the 0.05 significance level. This showed that considerations and choices for walkability had direct influences on livability perceptions, while those for safety had indirect impacts on livability through mediating by perceived safety. A racial factor (White vs. non-White), an employment status, and a household income level presented different results between direct and indirect relationships with livability perception, and between indirect relationships through walking and safety perception. The finding included opposite directions between direct and indirect relationships and between relationships with mediators (walking vs. safety) both of which were related to higher livability perceptions. The findings of this study suggest that neighborhood walking, walkability, perceived and objective safety are definitely attributable to a higher level of life satisfaction, and many of the personal and household factors (e.g. age, income, education, marital status) were directly and differently associated with neighborhood life satisfaction.

On the subject of neighborhood walkability and safety, preference and environmental discordances constrained the desired level of behaviors and lifestyles at a community level. Identifying if the neighborhood discordance, between expectations and reality in neighborhood choices, operates as a loss of expected utility constraining the desired levels of behaviors and neighborhood satisfactions, or merely as socio-demographical variations in neighborhood choices meeting the demands will offer directions for where we should move forward to encourage a healthier lifestyle and life satisfaction. Conducting a comprehensive examination of the links among neighborhood choices, neighborhood preferences, walking behaviors, perceived safety, and livability are necessary to present clear evidence on the importance of being able to select a neighborhood that matches an individual's residential preference. On the road to the complete examination, this study developed a systematic evaluation framework for neighborhood walkability and safety quality in terms of infrastructure, greenery, crime and crash risks, destination land uses, and density. Observing the different levels of walking behavior and neighborhood safety between neighborhood concordance and discordance groups, and identifying the inherent personal and environmental factors of the neighborhood discordance will support a better understanding of the interrelationships between the built and social environments and residential preferences underlying walkable and safe neighborhood choices. Providing a sufficient number of walkable and safe neighborhoods, especially for residents who prefer to live in these types of neighborhoods, will improve their quality of life. Furthermore, understating the dynamic relationships among residential preference, choice, walking, and safety, and life satisfaction will provide abundant and useful insights on their relationships varying by different groups of populations.

CHAPTER VI

CONCLUSION

This dissertation research identified how certain preferred environmental attributes were differently valued for home purchases by people with different personal or household characteristics and community settings, by capturing the willingness-to-live for walkable safe environments. It also examined whether the "neighborhood discordance" between expectations and reality in neighborhood choices operates as a loss of expected utility constraining the desired levels of walking-oriented lifestyles and neighborhood safety and satisfactions, or merely as socio-demographical variations in neighborhood choices meeting the demands. Furthermore, this study explored what socio-demographic status resulted in the discordant residential location choices and what particular environmental features were selected because of preference or no preference for neighborhood walkability and safety. Findings from this study contribute to the existing body of literature and the guidance in developing environmental and policy interventions, by presenting a profound understanding of diverse residential demands within the larger context of the community environment and demographic shift, and additional insights on the dynamic relationships among residential preference, walking, safety, and livability.

6.1 CONCLUSION

This study is a cross-sectional study to 1) identify residential demands for neighborhood walkability and safety, and their variations by personal or household traits and community settings; and 2) investigate neighborhood discordance between considered and actual neighborhood environments, and its effects on walking behaviors and perceptions of safety and livability across different population groups. The conceptual frameworks of this dissertation study delineate the relationships among personal and household level characteristics, objective and perceived measures of physical and social environments, neighborhood considerations, neighborhood choices, their concordance and discordance regarding walkability and safety, walking behaviors, perceived neighborhood safety, and neighborhood livability. The conceptual frameworks were developed based on the social ecological theory (McLeroy et al., 1988), which is suitable for conceptualizing multilevel influences of built and socioeconomic environments and intrapersonal factors on individual behaviors. The conceptual models incorporate the two processes of neighborhood choices and travel choices. Interpersonal and interpersonal level characteristics interact with walking behaviors, and also influence community-level factors (e.g. residential location choices, neighborhood discordance) (Lee & Moudon, 2006b; Sallis et al., 2006). Neighborhood considerations, choices, and discordances are interrelated and independently influence walking behaviors. Further, all levels of factors encouraging walking behaviors and perceived safety are linked to more residents being satisfied with life in the neighborhood (Kahana et al., 2003; Lovejoy et al., 2010).

From literature reviews, personal predispositions toward neighborhood environments have been known to be related to personal or household traits, lifestyle preferences, and access to work or services (Boumeester, 2011; Jansen, 2014). A small number of studies have ascertained to a certain degree public support for the walking-oriented community developments which was depicted as a community design with higher-density, mixed-use structures (Handy et al., 2008; Morrow-Jones et al., 2004; Myers & Gearin, 2001). The findings have summarized that the walking-oriented community designs were favored by non-rural, non-White, older, educated residents, and residents with or without children. Some other studies of discordance of stated preferences with current neighborhood types examined the restraining effects of discordances on desired travel behaviors (Frank et al., 2007; Schwanen & Mokhtarian, 2005a, 2005b). The studies found both attitudinal preference factors and current environmental factors independently impacted travel distances and mode choices, and the unmatched residential locations were attributed to decreases in the desired level of non-motorized travel behaviors. However, their measurements of stated preferences were merely to capture current attitudes and desired types of residences. To encourage public support for the development of walkable communities, it is important to capture the willingness-to-live and willingness-to-pay for the walking-oriented and safe developments, since moving is always accompanied by other factors regarding economics and utility (Karsten, 2007; Mohan & Twigg, 2007). A few studies compared walkability considerations and the walkability of current communities. Their findings showed an inconsistency where walkability consideration was positively associated with perceived walkability, but not significantly with objective walkability. Even though the finding suggested distinctions between stated preferences and neighborhood considerations, the studies did not contain the relationships between neighborhood considerations and travel behaviors or walking, or any examinations for environmental correlates of neighborhood considerations.

Therefore, to fill the research gaps, this dissertation study examined the potential associations of neighborhood consideration, choice, and discordance with walking for transportation and perceived safety, using survey and GIS datasets from two recently completed research projects, one conducted in two rural towns and the other in four urban towns in Texas. Personal and household characteristics variables were collected from two surveys across walking for transportation and recreation, perceived environments, personal demographics, personal attitudes or activities, and household characteristics. Multi-aspects attributes of built and social environments were measured objectively based on respondents' home locations within 1km circular and sausage network buffers as an accessible distance on foot to destinations in their communities. Their raw data were acquired from federal, state, and local government offices and departments. The attributes encompassed seven general categories: 1) transportation and pedestrian infrastructures, 2) natural environment, 3) safety-related risks, 4) generalized land uses, 5) neighborhood destinations, 6) residential and employment densities, and 7) regional home locations.

Study 1 and study 2 were conducted utilizing the survey and objective measures across the total sample (n=630) and four subsamples: urban (n=294), rural (n=336), older (n=366), and middle-aged (n=264). Study 1 identified personal and household level predictors and environmental correlates of walkability and safety considerations, and their variations across the total sample and subsamples. In comparing subsamples, urban and rural subsamples exhibited obvious differences underscoring different lifestyle preferences in terms of auto ownerships and walking orientations. Older and middle-aged adults presented apparent differences in lifecycle stages. Regarding environmental conditions, urban and middle-aged adults' communities were definitely compact and mixed in urban forms and land uses with intensive infrastructure systems and higher crime and crash rates compared to their counterparts. Study 1 discovered latent preferences for neighborhood attributes which underlay neighborhood considerations when making residential choices. People who possess a positive predisposition toward a walkable community show a propensity to consider walkability as well as safety when they choose residences. However, people having a penchant for neighborhood safety are inclined to consider neighborhood attractiveness together with safety rather than walkability. As characteristics of walkability and safety advocates, proponents of walkability were subject to be non-White, pro-safety, utilitarian walkers, non-obese, less educated, and long-term residents residing closer to CBDs. Proponents of safety were liable to be non-Hispanic, pro-attractiveness, utilitarian walkers, and short-term residents residing in rural towns. Both neighborhoods considered as walkable and safe involved high perceived safety from traffic but low safety for walking. But then, walkability consideration was related to accessibility to destinations and fewer single family residences and industrial areas. Safety consideration was associated with more multifamily residences and service destinations, and fewer recreational lands and food destinations.

Study 2 developed a systematic evaluation framework of neighborhood walkability and safety to conduct a comprehensive examination of the links among neighborhood discordances, walking behaviors, perceived safety, and livability. The Utilitarian Walkability Index (UWI) is mainly composed of a physical environmental facet and a walking-related safety facet. The physical aspect of utilitarian walkability was a function of density, accessibility, connectivity, and pedestrian infrastructure. The safety aspect was equal to the Neighborhood Safety Index (NSI) which was a function of traffic-related safety, crime-related safety, pedestrian infrastructure, and greenery. The rates of neighborhood walkability considerations that matched choices of walkable neighborhoods were 65.5%. As predictors of mismatch between the preferred and actual environmental attributes, age, race/ethnicity, SES (e.g. education, the number of vehicles), the length of residence, and neighborhood attractiveness consideration were the most common personal or household factors across the total sample and subsamples. Walkability discordance was related to the low level of walking-friendly environments (e.g. employment density, accessibility to destinations, direct streets), while safety discordance was associated with low employment density, fewer pedestrian facilities, high crime and crash rates, and direct street patterns. “No preference” for neighborhood walkability and safety played a role for residents to self-select particular environmental features such as fewer crosswalks and green spaces, and low employment density.

Both preference discordance and environmental discordance had significant influences on walking and perceived safety across the total sample and subsamples. However, in terms of walkability, variations in preferences or environmental conditions had no impact on walking among those in non-walkable neighborhoods or with no preference. Regarding livability, both walking for any purpose and a higher perception of safety were related to a higher level of livability perception. Walking and safety were found to mutually influence each other. Neighborhood consideration and choice for walkability also directly impacted the livability perception independent of walking. Both Study 1 and Study 2 identified personal and environmental correlates of residential preferences for walkable and safe neighborhoods, and variations between two substudies were found. Study 1 addressed preferences of all residents, but Study 2 focused on preferences among residents in walkable or safe communities. A racial factor (i.e. non-White), safety consideration, the length of residence, and safety perceptions were found to be common correlates of walkability considerations in both studies, while Hispanic origin, attractiveness consideration, utilitarian walking, dwelling length, and green spaces were shared correlates of safety considerations. Regional home locations, industrial and recreation land uses, and neighborhood destinations were important for residential preferences in Study 1, while crosswalk availability, green spaces, and employment density were significant in Study 2.

6.2 IMPLICATIONS AND CONTRIBUTIONS

This dissertation research contributes to a multidisciplinary approach across the housing, community development, urban planning, and public health fields from several perspectives providing a comprehensive understanding to the existing literature and informative implications to policy implementations, in accordance with residential preferences, active lifestyles, and life satisfactions.

First, this study notes that residential preferential preferences for neighborhood walkability are closely related to preferences for neighborhood safety, but they are not identical. Even though a majority (75%) of safe neighborhoods was evaluated as walkable as well, only 20% of neighborhood safety proponents reported a walkability preference for their current residences. This finding adds to the existing literature a new insight for how walking-related safety and overall neighborhood safety should be distinguished regarding residential preferences, and the links between preferred attributes and considered attributes in residential selections. Naturally, future research and designers and planners necessarily need to deal with neighborhood safety as an important facet of walkability, but consider that safety is a multi-faceted concept and walking-related safety is one of its facets in drawing up new communities. At the same time, efforts to break stereotype perceptions where walking-oriented environments are less safe than suburban type developments are a prerequisite in developing policies and encouraging walking (Van Cauwenberg et al., 2011). In addition, future research is also required to conceptualize multi-faceted neighborhood safety and provide a measurement framework of objective evaluations (Bracy et al., 2014).

Second, safety preference and a safe environment had influences on the safety perception within the same preference groups (among residents having a preference or having no preference) or environment groups (among residents in safe sites or in unsafe sites). But, walkability preference and walkable environment showed no influence on walking among residents having no preference or living in unsafe sites. Hence, complete interventions for both supportive environments and enhanced attitudes toward walkability should be developed and implemented to promote neighborhood walking (Bohte et al., 2009). Despite safety perceptions being improved by a single-aspect intervention (environmental support or improved attitudes), environmental and policy interventions are needed to improve the actual level of neighborhood safety and encourage physical activities and walking (Bracy et al., 2014; Foster & Giles-Corti, 2008).

Third, walking for any purpose, walkability preference, neighborhood walkability, perceived and objective safety obviously result in a higher level of neighborhood satisfaction. Furthermore, walking for any purpose and neighborhood safety perceptions were interrelated mutually influencing each other. A body of studies has discovered higher levels of moderate or vigorous intensity physical activity were associated with higher HRQL scores and self-reported life satisfactions (Brown et al., 2003; Vuillemin et al., 2005; Wendel-Vos et al., 2004). Walkability and safety at neighborhood levels also have been documented to be associated with higher neighborhood satisfactions. Moreover, influences of safety perceptions on walking were found by a large number of previous studies and documented from review studies (Saelens & Handy, 2008; Van Cauwenberg et al., 2011; Won et al., 2016). However, the roles of walking itself on perceived safety and neighborhood satisfactions, whose significances are found in the current study, are still not evident from the existing literature (Fisher & Li, 2004). To promote the benefits of walking and raise preference for walkability, more relationships should be examined by future research.

Finally, exploring the nature of understudied population groups (e.g. automobile and walking oriented lifestyles, obviously different lifecycle stages) and their personal/household variations (e.g. race/ethnicity, personal attitudes, residential experiences) in their residential preferences regarding neighborhood walkability and safety can offer useful information on housing markets for community developers and local planners, so that they understand how different groups of home owners value different walking-friendly features when buying homes by addressing the willingness-to-pay for neighborhood walkability and safety. Environmental characteristics such as density, mixed land uses, access to destinations, pedestrian infrastructure, and perceived safety are differently valued by various sub-populations according to their housing demands and preferences. Low levels of walking-friendly environments (e.g. employment density, accessibility to destinations, low crime and crash rates) are attributed to constraining the desirable level of walking, safety, and livability. Further efforts are needed to better understand diverse residential demands within the larger context of the community environment and demographic shifts. This dissertation study closes highlighting the necessity of an adequate supply of walkable neighborhoods to underscore the intended benefits, especially when appropriately matched with the people who prefer living in walkable neighborhoods.

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APPENDIX A

A-1) Circular Buffer Analyses: Environmental Correlates of Walkability Considerations

Environmental Correlates of the Odds of Neighborhood Walkability Considerations: Multivariate Relationships Controlling for Covariates by the Total Sample, Urban, and Rural Subsamples

Domains and variables	Total		Urban		Rural	
	OR	p-value	OR	p-value	OR	p-value
Self-reported perceived safety						
Perceived safety related to traffic	1.470	0.009			1.988	0.003
Perceived safety related to walking	0.737	0.035			0.567	0.006
Objective measure - Infrastructures						
Presence of highway			2.388	0.025		
Objective measure - Greenery						
Mean of NDVIs: ranging 100 to -100			0.857	0.007		
Objective measure - Generalized land uses						
% of single family residential uses					0.969	0.064
% of commercial uses			1.073	0.002		
Objective measure - Destinations						
Number of food stores	1.098	0.034				
Presence of shopping malls			2.909	0.024		
Number of service destinations	1.041	0.035			1.125	0.000
Objective measure - Density						
Parcels with large businesses			0.463	0.007		
Akaike information criterion (AIC)	535.874		219.772		272.477	
Bayesian information criterion (BIC)	575.843		249.214		314.031	

Environmental Correlates of the Odds of Neighborhood Walkability Considerations: Multivariate Relationships Controlling for Covariates by the Total Sample, Older, and Middle-aged Subsamples

Domains and variables	Total		Older		Middle-aged	
	Odds Ratio	p-value	Odds Ratio	p-value	Odds Ratio	p-value
Self-reported perceived safety						
Perceived safety related to traffic	1.470	0.009	1.602	0.019		
Perceived safety related to walking	0.737	0.035			0.566	0.007
Objective measure - Infrastructures						
Presence of crosswalks					2.882	0.031
Presence of highway			2.249	0.012		
Objective measure - Greenery						
Mean of NDVIs: ranging 100 to -100						
Objective measure - Generalized land uses						
Presence of civic use					3.150	0.001
Objective measure - Destinations						
Number of food stores	1.098	0.034				
Presence of shopping malls					3.629	0.001
Number of service destinations	1.041	0.035	1.091	0.000		
Akaike information criterion (AIC)	535.874		278.157		224.049	
Bayesian information criterion (BIC)	575.843		305.243		252.656	

A-2) Circular Buffer Analyses: Environmental Correlates of Safety Considerations

Environmental Correlates of the Odds of Neighborhood Safety Considerations: Multivariate Relationships Controlling for Covariates by the Total Sample, Urban, and Rural Subsamples

Domains and variables	Total		Urban		Rural	
	OR	p-value	OR	p-value	OR	p-value
Self-reported perceived safety						
Perceived safety related to traffic			1.533	0.019		
Perceived safety related to walking			0.601	0.011		
Objective measure - Crime and crash						
Yearly violent crimes					0.827	0.047
Yearly pedestrian/cyclist crashes	0.177	0.002				
Objective measure - Generalized land uses						
Presence of park/recreational uses	0.437	0.008	0.459	0.041		
Objective measure – Destinations						
Number of food stores			0.866	0.000		
Number of food services					1.175	0.021
Number of drug stores and video services					0.499	0.022
Objective measure – Density						
Total housing: 100 units	1.002	0.003	1.001	0.038		
Akaike information criterion (AIC)	458.882		309.272		132.402	
Bayesian information criterion (BIC)	503.243		342.393		166.621	

Environmental Correlates of the Odds of Neighborhood Safety Considerations: Multivariate Relationships Controlling for Covariates by the Total Sample, Older, and Middle-aged Subsamples

Domains and variables	Total		Older		Middle-aged	
	OR	p-value	OR	p-value	OR	p-value
Objective measure - Infrastructures						
Presence of highway			0.531	0.051		
Objective measure - Crime and crash						
Yearly pedestrian/cyclist crashes	0.177	0.002				
Objective measure - Generalized land uses						
% of multifamily residential uses					1.188	0.016
Presence of park/recreational use	0.437	0.008	0.289	0.004		
% of undeveloped lands			0.973	0.027		
Objective measure - Destinations						
Number of food stores					0.819	0.002
Objective measure – Density						
Total housing: 100 units	1.002	0.003				
Akaike information criterion (AIC)	458.882		285.391		178.803	
Bayesian information criterion (BIC)	503.243		312.709		203.835	

APPENDIX B

B-1) Circular Buffer Analyses: Correlates of Walkability-related Discordances

Personal/household Predictors of Discordances Regarding Walkability in the Total Sample: A Summary Table of Multiple Comparison Results

Domains and variables	Groups; N (%) or Mean ± SD				
	(N)	(P)	(W)	(C)[a]	Total
Personal – demographics					
Gender: Male (ref= female)	141 (45.6%)	87 (41.8%)	12 (-) (27.3%)	37 (53.6%)	277 (44.0%)
Age: ranging 50 – 92 years	67.46 ±9.142	67.63 ±10.254	66.39 ±10.246	66.96 ±9.655	67.39 ±9.638
65 years or older (ref= < 65)	187 (60.5%)	119 (57.2%)	20 (45.5%)	40 (58.0%)	366 (58.1%)
70 years or older (ref: <70)	118 (38.2%)	88 (42.3%)	15 (34.1%)	26 (37.7%)	247 (39.2%)
Hispanic, Latino or Spanish origin (ref= others)	15 (-) (4.9%)	15 (-) (7.2%)	4 (9.1%)	15 (21.7%)	49 (7.8%)
Race: non-Hispanic, White (ref= others)	276 (+) (89.6%)	188 (+) (90.4%)	36 (81.8%)	51 (73.9%)	551 (87.6%)
Obesity: BMI>=30 (ref: non-obese (BMI<30))	70 (23.3%)	52 (25.7%)	8 (19.5%)	13 (19.1%)	143 (23.4%)
Marital status: Married (ref: unmarried)	224 (73.2%)	147 (70.7%)	28 (65.1%)	52 (75.4%)	451 (72.0%)
Education level: some college or higher (ref= lower than some college)	267 (+) (87.0%)	169 (81.3%)	34 (77.3%)	51 (73.9%)	521 (83.0%)
Employment Status: for wages/self-employed (ref= unemployed)	155 (50.7%)	97 (46.6%)	22 (50.0%)	38 (55.1%)	312 (49.8%)
Working hours per week	20.922 ±1.210	20.842 ±1.474	21.396 ±3.263	20.064 ±2.489	20.797 ±0.844
Personal – attitudes and activities					
Housing affordability consideration	194 (62.8%)	128 (61.5%)	29 (65.9%)	52 (75.4%)	403 (64.0%)
Attractiveness consideration	275 (89.0%)	175 (84.1%)	41 (93.2%)	57 (82.6%)	548 (87.0%)
Safety consideration	256 (82.8%)	157 (75.5%)	41 (93.2%)	59 (85.5%)	513 (81.4%)
Any difficulty in walking (ref= no difficulty)	31 (10.0%)	39 (18.8%)	3 (6.8%)	9 (13.0%)	82 (13.0%)
Someone to walk with (ref= no one)	217 (70.5%)	125 (60.1%)	35 (79.5%)	41 (59.4%)	418 (66.5%)
PA at work: standing/walking/heavy labor (ref= no work/sitting)	59 (19.2%)	38 (18.4%)	10 (22.7%)	21 (30.9%)	128 (20.4%)
Screen/sitting hours per week	17.08 ±12.359	15.79 ±12.192	13.98 ±8.881	16.32 ±15.572	16.36 ±12.494
Walking for all purposes per week: 150+ min. (ref: 0-149 min.)	122 (39.6%)	87 (42.0%)	24 (54.5%)	31 (44.9%)	264 (42.0%)
Walking for transportation per week: 1+ min. (ref: 0 min.)	117 (-) (38.0%)	74 (-) (35.7%)	21 (47.7%)	42 (60.9%)	254 (40.4%)
Walking for recreation per week: 150+ min. (ref: 0-149 min.)	114 (36.9%)	78 (37.5%)	24 (+) (54.5%)	20 (29.0%)	236 (37.5%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.

Continued

Domains and variables	Groups; N (%) or Mean ± SD				
	(N)	(P)	(W)	(C)[a]	Total
Household characteristics					
Length of residence	17.41 ±12.351	19.02 ±13.037	21.30 ±12.641	21.68 ±15.140	18.69 ±12.986
The number of vehicles	2.08 ±0.953	2.02 ±0.965	1.75 ±0.719	1.91 ±0.951	2.02 ±0.945
The number of children	0.12 ±0.485	0.11 ±0.474	0.00 ±0.000	0.25 ±0.736	0.12 ±0.501
The presence of children in household	26 (8.4%)	14 (6.7%)	0 (0.0%)	9 (13.0%)	49 (7.8%)
Annual household income[b]	4.14 ±1.645	3.99 ±1.738	3.87 ±1.818	3.61 ±1.758	4.02 ±1.703
Annual household income (>=$50k)	200 (67.3%)	119 (62.6%)	20 (52.6%)	37 (55.2%)	376 (63.5%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.
[b] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" ≥$150k.

Environmental Correlates of Discordances Regarding Walkability in the Total Sample: A Summary Table of Multiple Comparison Results

Domains and variables	Groups; N (%) or Mean ± SD				
	(N)	(P)	(W)	(C)[a]	Total
Self-reported perceived safety					
Perceived safety related to traffic	1.76 ±0.833	2.00 ±0.831	2.14 ±0.878	2.04 ±0.946	1.90 ±0.857
Perceived safety related to crime	2.25 ±0.781	2.34 ±0.788	2.27 ±0.845	2.30 ±0.734	2.29 ±0.782
Perceived safety related to walking	2.14 ±0.810	2.25 ±0.791	1.95 ±0.861	2.04 ±0.865	2.15 ±0.817
Overall perceived safety	6.15 ±1.781	6.59 ±1.686	6.36 ±1.989	6.39 ±1.873	6.33 ±1.782
Objective measure - Infrastructures					
Number of crosswalks[b]	68 (-) (22.0%)	161 (77.4%)	10 (-) (22.7%)	57 (82.6%)	296 (47.0%)
Intersection density[b]	149 (-) (48.2%)	116 (55.8%)	20 (-) (45.5%)	50 (72.5%)	335 (53.2%)
Sidewalk completeness[b]	13 (-) (4.2%)	114 (54.8%)	2 (-) (4.5%)	43 (62.3%)	172 (27.3%)
Presence of railroad/highway[c]	79 (-) (25.6%)	92 (44.2%)	17 (38.6%)	41 (59.4%)	229 (36.3%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) a positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.
[b] Objectively measured and categorized with binary scale: "1" citywide mean or higher values and "0" lower value.
[c] Objectively measured with binary scale: "1" presence and "0" absence.
[d] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

Continued

Domains and variables	Groups; N (%) or Mean ± SD				
	(N)	(P)	(W)	(C)[a]	Total
Objective measure - Greenery					
Mean of NDVIs: ranging 100 to -100[d]	231 (+) (74.8%)	47 (22.6%)	26 (+) (59.1%)	6 (8.7%)	310 (49.2%)
Objective measure - Crime and crash					
Density of violent crimes[b]	84 (-) (27.2%)	121 (58.2%)	18 (-) (40.9%)	46 (66.7%)	269 (42.7%)
Density of sex offenders[b]	120 (-) (38.8%)	141 (67.8%)	18 (-) (40.9%)	53 (76.8%)	332 (52.7%)
Density of pedestrian/cyclist crashes[b]	88 (-) (28.5%)	158 (-) (76.0%)	16 (-) (36.4%)	63 (91.3%)	325 (51.6%)
Density of total crashes[b]	68 (-) (22.0%)	148 (-) (71.2%)	13 (-) (29.5%)	65 (94.2%)	294 (46.7%)
Objective measure – Destinations					
Number of destinations[b]	68 (-) (22.0%)	166 (-) (79.8%)	13 (-) (29.5%)	66 (95.7%)	313 (49.7%)
Objective measure – Density					
Density of housing units[d]	96 (-) (31.1%)	145 (69.7%)	15 (-) (34.1%)	50 (72.5%)	306 (48.6%)
Density of parcels with >100 employees[d]	44 (-) (14.2%)	141 (67.8%)	5 (-) (11.4%)	51 (73.9%)	241 (38.3%)
Density of employees in large (>100) businesses[d]	10 (-) (3.2%)	114 (-) (54.8%)	1 (-) (2.3%)	51 (73.9%)	176 (27.9%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) a positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.
[b] Objectively measured and categorized with binary scale: "1" citywide mean or higher values and "0" lower value.
[c] Objectively measured with binary scale: "1" presence and "0" absence.
[d] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

B-2) Circular Buffer Analyses: Correlates of Safety-related Discordances

Personal/household Predictors of Discordances Regarding Safety in the Total Sample: A Summary Table of Multiple Comparison Results

Domains and variables	Groups; N (%) or Mean ± SD				Total
	(N)	(P)	(W)	(C)[a]	
Personal - demographics					
Gender: Male (ref: female)	30 (46.9%)	29 (54.7%)	109 (41.3%)	109 (43.8%)	277 (44.0%)
Age: ranging 50 – 92 years	67.66 ±9.212	68.38 ±9.686	68.27 ±9.710	66.17 ±9.583	67.39 ±9.638
65 years or older (ref= < 65)	41 (64.1%)	34 (64.2%)	156 (59.1%)	135 (54.2%)	366 (58.1%)
70 years or older (ref: <70)	25 (39.1%)	24 (45.3%)	114 (43.2%)	84 (33.7%)	247 (39.2%)
Hispanic, Latino or Spanish origin (ref= others)	11 (17.2%)	6 (11.5%)	11 (4.2%)	21 (8.4%)	49 (7.8%)
Race: non-Hispanic, White (ref= others)	52 (81.3%)	44 (84.6%)	236 (89.4%)	219 (88.0%)	551 (87.6%)
Obesity: BMI>=30 (ref: non-obese (BMI<30))	14 (23.3%)	17 (32.7%)	50 (19.2%)	62 (25.9%)	143 (23.4%)
Marital status: Married (ref: unmarried)	39 (-) (60.9%)	38 (73.1%)	181 (69.3%)	193 (77.5%)	451 (72.0%)
Education level: some college or higher (ref= lower than some college)	48 (75.0%)	43 (82.7%)	223 (84.8%)	207 (83.1%)	521 (83.0%)
Employment Status: for wages/self-employed (ref= unemployed)	28 (43.8%)	24 (47.1%)	129 (49.0%)	131 (52.6%)	312 (49.8%)
Working hours per week	14.37 ±18.405	19.57 ±22.718	15.35 ±20.892	17.19 ±20.878	16.32 ±20.797
Personal – attitudes and activities					
Housing affordability consideration	40 (62.5%)	26 (49.1%)	175 (66.3%)	162 (65.1%)	403 (64.0%)
Attractiveness consideration	37 (-) (57.8%)	33 (-) (62.3%)	249 (94.3%)	229 (92.0%)	548 (87.0%)
Walkability consideration	7 (10.9%)	6 (11.3%)	41 (15.5%)	59 (23.7%)	113 (17.9%)
Any difficulty in walking (ref= no difficulty)	14 (+) (21.9%)	12 (+) (22.6%)	36 (13.6%)	20 (8.0%)	82 (13.0%)
Someone to walk with (ref= no one)	35 (54.7%)	31 (58.5%)	186 (70.5%)	166 (66.9%)	418 (66.5%)
PA at work: standing/walking/heavy labor (ref= no work/sitting)	13 (21.0%)	10 (18.9%)	53 (20.2%)	52 (21.0%)	128 (20.4%)
Screen/sitting hours per week	15.57 ±12.392	15.54 ±14.543	17.00 ±12.586	16.06 ±11.996	16.36 ±12.494
Walking for all purposes per week: 150+ min. (ref: 0-149 min.)	20 (31.3%)	13 (-) (24.5%)	110 (41.8%)	121 (48.8%)	264 (42.0%)
Walking for transportation per week: 1+ min. (ref: 0 min.)	14 (-) (21.9%)	8 (-) (15.4%)	115 (43.7%)	117 (47.0%)	254 (40.4%)
Walking for recreation per week: 150+ min. (ref: 0-149 min.)	19 (29.7%)	11 (-) (20.8%)	102 (38.6%)	104 (41.8%)	236 (37.5%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.

Continued

Domains and variables	Groups; N (%) or Mean ± SD				Total
	(N)	(P)	(W)	(C)[a]	
Household characteristics					
Length of residence	23.33 ±13.073	23.45 ±16.290	16.57 ±11.650	18.71 ±13.018	18.69 ±12.986
The number of vehicles	1.89 ±0.799	2.13 ±1.010	1.99 ±0.963	2.06 ±0.946	2.02 ±0.945
The number of children	.09 ±0.426	.09 ±0.354	.11 ±0.490	.15 ±0.554	.12 ±0.501
The presence of children in household	4 (6.3%)	4 (7.5%)	18 (6.8%)	23 (9.2%)	49 (7.8%)
Annual household income[b]	3.61 ±1.552	4.10 ±1.825	3.96 ±1.690	4.17 ±1.719	4.02 ±1.703
Annual household income (>=$50k)	36 (59.0%)	29 (60.4%)	158 (62.5%)	153 (66.5%)	376 (63.5%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) the positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.
[b] Measured with a 7-point scale: "1" <$25k, "2" $25k-$34.9k, "3" $35k-$49.9k, "4" $50k-$74.9k, "5" $75k-$99.9k, "6" $100k-$149.9k, and "7" ≥$150k.

Environmental Correlates of Discordances Regarding Safety in the Total Sample: A Summary Table of Multiple Comparison Results

Domains and variables	Groups; N (%) or Mean ± SD				Total
	(N)	(P)	(W)	(C)[a]	
Self-reported perceived safety					
Perceived safety related to traffic	1.67 ±0.892	1.83 ±0.849	1.89 ±0.834	1.97 ±0.868	1.90 ±0.857
Perceived safety related to crime	2.09 ±0.886	2.30 ±0.799	2.33 ±0.785	2.29 ±0.744	2.29 ±0.782
Perceived safety related to walking	1.97 ±0.959	2.38 ±0.686	2.19 ±0.794	2.12 ±0.817	2.15 ±0.817
Overall perceived safety	5.73 ±1.954	6.51 ±1.793	6.41 ±1.733	6.38 ±1.767	6.33 ±1.782
Objective measure - Infrastructures					
Number of crosswalks[b]	38 (59.4%)	37 (69.8%)	92 (-) (34.8%)	129 (51.8%)	296 (47.0%)
Intersection density[b]	51 (+) (79.7%)	10 (18.9%)	197 (+) (74.6%)	77 (30.9%)	335 (53.2%)
Sidewalk completeness[b]	5 (-) (7.8%)	21 (39.6%)	33 (-) (12.5%)	113 (45.4%)	172 (27.3%)
Presence of railroad/highway[c]	34 (53.1%)	24 (45.3%)	81 (30.7%)	90 (36.1%)	229 (36.3%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) a positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.
[b] Objectively measured and categorized with binary scale: "1" citywide mean or higher values and "0" lower value.
[c] Objectively measured with binary scale: "1" presence and "0" absence.
[d] Objectively measured and categorized with binary scale: "1" sample-basis mean of the city or higher values and "0" lower value.

Continued

Domains and variables	Groups; N (%) or Mean ± SD				Total
	(N)	(P)	(W)	(C)[a]	
Objective measure - Greenery					
Mean of NDVIs[d]	37 (+) (57.8%)	19 (35.8%)	163 (+) (61.7%)	91 (36.5%)	310 (49.2%)
Objective measure - Crime and crash					
Density of violent crimes[b]	42 (+) (65.6%)	26 (49.1%)	98 (37.1%)	103 (41.4%)	269 (42.7%)
Density of sex offenders[b]	49 (+) (76.6%)	26 (49.1%)	129 (48.9%)	128 (51.4%)	332 (52.7%)
Density of pedestrian/cyclist crashes[b]	44 (68.8%)	30 (56.6%)	120 (45.5%)	131 (52.6%)	325 (51.6%)
Density of total crashes[b]	38 (59.4%)	27 (50.9%)	104 (39.4%)	125 (50.2%)	294 (46.7%)
Objective measure - Destinations					
Number of destinations[b]	37 (57.8%)	31 (58.5%)	116 (43.9%)	129 (51.8%)	313 (49.7%)
Objective measure – Density					
Density of housing units[d]	37 (57.8%)	21 (39.6%)	119 (45.1%)	129 (51.8%)	306 (48.6%)
Density of parcels with large businesses[d]	18 (28.1%)	27 (50.9%)	81 (-) (30.7%)	115 (46.2%)	241 (38.3%)
Density of employees in large businesses[d]	18 (28.1%)	21 (39.6%)	45 (-) (17.0%)	92 (36.9%)	176 (27.9%)

[a] A reference group; compared to (C) the positive concordance group, (+) indicates the likelihood of higher values (or %) for belonging to the (P) preference discordance, (W) walkability discordance, or (N) negative concordance group; and (-) indicates the likelihood of higher values (or %) for belonging to (C) a positive concordance group at a 0.05 significance level, with p-values adjusted using the Bonferroni method.
[b] Objectively measured and categorized with binary scale: “1” citywide mean or higher values and “0” lower value.
[c] Objectively measured with binary scale: “1” presence and “0” absence.
[d] Objectively measured and categorized with binary scale: “1” sample-basis mean of the city or higher values and “0” lower value.

APPENDIX C

C-1) Circular Buffer Analyses: Influences of Neighborhood Discordances on Utilitarian Walking

Relationships between Walkability-related Discordances and Utilitarian Walking: Results from Multivariate Analyses in the Total Sample, Urban, and Rural Subsamples

Covariates and independent variables	Total		Urban		Rural	
	OR	p-value	OR	p-value	OR	p-value
Gender: Male (ref: female)	1.671	0.016	2.670	0.007		
Race: non-Hispanic, White (ref= others)	0.472	0.023	0.320	0.011		
Employment Status: for wages/self-employed (ref= unemployed)					1.866	0.010
Safety consideration	2.183	0.016			2.272	0.068
Any difficulty in walking (ref= no difficulty)	0.431	0.017	0.354	0.064	0.399	0.041
Screen/sitting hours per week	0.983	0.046	0.950	0.077		
Annual household income	0.827	0.005	0.793	0.026		
The % of parcel areas built after moving	0.988	0.180	0.983	0.180	0.987	0.295
Perceived safety related to traffic	1.436	0.005			1.404	0.024
Perceived safety related to crime			1.703	0.038		
Discordances and negative concordance (ref = positive concordance)						
- (N) Negative concordance	0.348	0.002	0.645	0.425	0.116	0.001
- (P) Preference discordance	0.457	0.030	0.981	0.972	0.130	0.002
- (E) Walkability discordance	0.367	0.044	0.241	0.229	0.143	0.008
Akaike information criterion (AIC)	631.848		248.775		421.452	
Bayesian information criterion (BIC)	693.146		281.773		451.988	
Intraclass correlation coefficient (ICC)	0.270		-		-	

Relationships between Walkability-related Discordances and Utilitarian Walking: Results from Multivariate Analyses in the Total Sample, Older, and Middle-aged Subsamples

Covariates and independent variables	Total		Older		Middle-aged	
	OR	p-value	OR	p-value	OR	p-value
Gender: Male (ref: female)	1.671	0.016				
Race: non-Hispanic, White (ref= others)	0.472	0.023				
Safety consideration	2.183	0.016	2.092	0.061		
Any difficulty in walking (ref= no difficulty)	0.431	0.017	0.277	0.004		
Screen/sitting hours per week	0.983	0.046			0.979	0.069
Annual household income	0.827	0.005	0.843	0.041	0.787	0.020
The % of parcel areas built after moving	0.988	0.180	0.988	0.275	0.999	0.948
Perceived safety related to traffic	1.436	0.005			1.650	0.012
Perceived safety related to crime			1.614	0.011		
Discordances and negative concordance (ref = positive concordance)						
- (N) Negative concordance	0.348	0.002	0.267	0.004	0.366	0.065
- (P) Preference discordance	0.457	0.030	0.367	0.039	0.375	0.078
- (E) Walkability discordance	0.367	0.044	0.407	0.209	0.212	0.032
Akaike information criterion (AIC)	631.848		377.418		278.047	
Bayesian information criterion (BIC)	693.146		419.472		313.381	
Intraclass correlation coefficient (ICC)	0.270		0.265		0.314	

C-2) Circular Buffer Analyses: Influences of Neighborhood Discordances on Perceived Safety

Relationships between Safety-related Discordances and Perceived Safety: Results from Multivariate Analyses in the Total Sample, Urban and Rural Subsamples

Covariates and independent variables	Total		Urban		Rural	
	B	p-value	B	p-value	B	p-value
Gender: Male (ref: female)	0.409	0.004			0.601	0.002
Education level: some college or higher (ref= lower than some college)			0.498	0.042		
Employment Status: for wages/self-employed (ref= unemployed)			0.590	0.003		
Attractiveness consideration	0.990	0.000	1.230	0.000		
Walking for transportation per week: 1+ min. (ref: 0 min.)	0.476	0.003	0.710	0.007	0.452	0.024
Presence of children in household			-0.855	0.021		
Annual household income	0.107	0.013			0.149	0.014
The % of parcel areas built after moving	-0.001	0.804	0.001	0.929	0.004	0.678
Discordances and negative concordance (ref = positive concordance)						
- (N) Negative concordance	-0.292	0.261	-0.284	0.353	-0.881	0.072
- (P) Preference discordance	0.411	0.144	0.445	0.168	0.275	0.636
- (E) Safety discordance	-0.081	0.602	-0.224	0.340	0.064	0.753
Akaike information criterion (AIC)	2325.209		1134.486		1215.896	
Bayesian information criterion (BIC)	2373.409		1178.483		1253.165	
Intraclass correlation coefficient (ICC)	0.080		0.054		0.176	

Relationships between Safety-related Discordances and Perceived Safety: Results from Multivariate Analyses in the Total Sample, Older and Middle-aged Subsamples

Covariates and independent variables	Total		Older		Middle-aged	
	B	p-value	B	p-value	B	p-value
Gender: Male (ref: female)	0.409	0.004			0.726	0.002
Age: ranging 50 – 92 years			0.035	0.011		
Marital status: Married (ref: unmarried)			0.621	0.001	-0.526	0.044
Education level: some college or higher (ref= lower than some college)			0.624	0.005		
Employment Status: for wages/self-employed (ref= unemployed)			0.389	0.038	0.538	0.036
Attractiveness consideration	0.990	0.000	0.893	0.001	0.955	0.010
Walking for transportation per week: 1+ min. (ref: 0 min.)	0.476	0.003	0.450	0.013		
Walking for recreation per week: 150+ min. (ref: 0-149 min.)			0.326	0.059	0.459	0.056
Annual household income	0.107	0.013				
The % of parcel areas built after moving	-0.001	0.804	-0.011	0.094	0.010	0.322
Discordances and negative concordance (ref = positive concordance)						
- (N) Negative concordance	-0.292	0.261	0.040	0.896	-0.847	0.046
- (P) Preference discordance	0.411	0.144	0.860	0.008	0.061	0.897
- (E) Safety discordance	-0.081	0.602	-0.129	0.493	-0.043	0.857
Akaike information criterion (AIC)	2325.209		1397.622		1063.526	
Bayesian information criterion (BIC)	2373.409		1452.182		1106.254	
Intraclass correlation coefficient (ICC)	0.080		0.044		0.124	