THE RELATIONSHIP OF NEIGHBORHOOD BUILT ENVIRONMENT FEATURES AND WALKING

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ABSTRACT

To date, the literature on urban design and walking has often emphasized more macro-scale features, such as block length and number of intersections, that are easier to measure remotely using GIS and or aerial photographs. Urban designers, in contrast, emphasize the importance of micro-scale features in individuals' use and experience of neighborhood environments. This paper moves beyond examining correlations of individual built environment features and walking, to begin to test proposals about which composite characteristics of the built environment (safety, comfort, etc.) may have the greatest impact on walking. Several urban design characteristics of 11 neighborhoods throughout California were collected. Self-report walking data on the number and types of walking trips were obtained from surveys administered to parents of 3^{rd}-5^{th} graders. Urban design features related to both accessibility and safety affect the amount of walking that adults do in their neighborhood. Grouping related urban design variables into indices provides some clarity as to how the built environment impacts walking. Safety emerges as the most important built environment characteristic (of those tested), related to both destination and recreational walking.

INTRODUCTION[1]

Physical activity is key to maintaining health and combating rising rates of obesity in the US and beyond (Centers for Disease Control and Prevention, 2006). In the US, the Surgeon General recommends a target of 30 minutes of moderate to vigorous physical activity most days of the week (Office of the Surgeon General, 2005). Yet only one third of American adults engaged in regular leisure time physical activity in 2003 (National Center for Health Statistics, 2005). Among adults who are not active for leisure, only about 1 in 5 work in a job category that involves physical activity (National Center for Health Statistics, 2005). The need remains for additional opportunities for physical activity.

Researchers and design and planning professionals affiliated with the "active living" movement hypothesize that the design of the neighborhood environment may support opportunities for physical activity, and especially walking for travel and for recreation (see, for example, Burden, 2000; Doyle, Kelly-Schwartz, Schlossberg, & Stockard, 2006; Fizgibbons & Stolley, 2004; Frank, Engelke & Schmid, 2003; Frumkin, Frank, & Jackson, 2004; Handy, et al., 2002; Local Government Commission, no date; Owen et al., 2000; Rodríguez, Khattak, & Evenson, 2006; Sallis, Bauman, & Pratt, 1998). Possible design strategies include limiting block length to increase accessibility, mixing land uses to incorporate nearby destinations to walk to, and beautifying streetscapes and planting street trees to promote strolling, among others.

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To date, the literature on urban design and walking has often emphasized more macro-scale features, such as block length and number of intersections, that are easier to measure remotely using GIS and or aerial photographs (see Cervero & Kockelman, 1997; Dill, 2003; Forsyth, 2005; Greenwald & Boarnet, 2002, Krizek, 2003a, 2003b; McCann & Ewing 2003; Moudon et al., 2004, and the discussion in Handy et al., 2002). Urban designers, in contrast, emphasize the importance of micro-scale features in individuals' use and experience of neighborhood environments (Carr et al., 1992; Gehl & Gemzøe, 2004; Jacobs, 1995.) Such micro-scale features would include the presence of street trees, sidewalk width, and the presence of abandoned buildings, and others. This paper focuses especially on the role of neighborhood scale, urban design features in walking among adults. The paper also moves beyond examining correlations of individual built environment features and walking, to begin to test proposals about which composite characteristics of the built environment (safety, comfort, etc.) may have the greatest impact on walking.

This paper takes advantage of data collected as part of an evaluation of the California Safe Routes to School (SR2S) program, to examine relationships between adult walking and built environment features in 11 California neighborhoods.

LITERATURE REVIEW

Research on Walking and the Built Environment

Recent years have seen an explosion of studies of the relationships between built environment features and physical activity. Two recent reviews, by Saelens, Sallis, and Frank (2003) and by Lee and Moudon (2004), summarize much of the empirical research on active

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[4] It is not possible, from these reviews, to determine whether any studies were included in both reviews.

living in the fields of transportation, urban design, and planning; and in public health (respectively). Together, these reviews examine a total of 36 empirical studies[4].

According to these reviews, factors associated with walking and nonmotorized transportation among adults include high population density; mixed land uses; sidewalk continuity; good pedestrian infrastructure; and overall neighborhood walkability (characterized by high density, mixed land use, high connectivity, and adequate walk/bike design, e.g., continuous sidewalks) (Saelens et al., 2003; also see Frank et al., 2005; Hoehner et al., 2005; King et al., 2003; Krizek & Johnson, 2006). Additional environmental factors linked to physical activity include the presence of facilities, travel distance, access to programs and facilities, the presence of sidewalks and bike lanes, quality and safety of sidewalks or bike lanes, traffic and other safety features, and the availability of pleasant routes (Lee & Moudon, 2004; also see de Bourdeaudhuij, Sallis, & Saelens, 2003; Hoehner et al., 2005).

In papers published since these reviews, additional built environment features that are linked to walking and other forms of active living include urban sprawl (Ewing et al., 2003); public transit (Hoehner et al., 2005); walkability at the county level (Doyle et al., 2006); and intersection density (Frank et al., 2005). Active living was also linked to perceived walkability at the neighborhood level (King et al., 2003); traditional neighborhood design (Handy, Cao, & Mokhtarian, 2006); neighborhood aesthetics (Hoehner et al., 2005); trails, streetlights, and access to places for physical activity (Huston, Evenson, Bors, & Bizlice, 2003); perceived access to recreational facilities (Hoehner et al., 2005); and distance to, attractiveness, and size of public open spaces (Giles-Corti et al., 2005).

Many studies examine correlations between individual built environment features and active living outcomes, including walking. In addition, Frank & colleagues (2006) found an association between walking and an "index" of built environment features, including land use mix, street connectivity, net residential density, and retail floor area ratios. Their findings suggest that neighborhood environments that support walking and physical activity are more than the sum of their discrete parts. Rather, built environment features may operate in concert to create places that, with the right mix and number of supportive elements, encourage physical activity.

Conceptual Framework

Researchers have identified many possible characteristics of the built environment that may impact walking—convenience, safety, and so on. It is likely that these characteristics do not all matter equally. Also, walking for different purposes—for example, for recreation versus for transportation—may depend upon different characteristics of the built environment. Alfonzo (2005) posits a hierarchy of walking needs, modeled after Maslow's hierarchy of human needs. In this model, accessibility is the most fundamental aspect of the built environment, in terms of its impact on decision of whether to walk. Access must be assured before other aspects of the built environment can be considered, in terms of decisions regarding walking. After accessibility, safety is proposed as the next most important built environment characteristic, followed by comfort, and then pleasurability. Unless "lower order" needs (such as access or safety) are met to a satisfactory extent, individuals will not consider "higher order" aspects of the built environment, such as comfort or pleasurability, in making decisions about whether to walk.

This model also suggests that a partitive analysis of the effect of the built environment on walking does not provide a thorough understanding of how various urban design elements may interact to create a place that facilitates more walking (Alfonzo, 2005). Instead, various grouped aspects of the built environment impact the decision to walk, and some groups of urban design variables don't factor in unless other elements of the built environment are already in place. This becomes important when making decisions with respect to design or planning interventions intended to increase walking. This paper takes this model into account in terms of forming groups of urban design variables – accessibility, safety, comfort, and pleasurability – as well as trying to understand their relative impact on the decision to walk.

METHODS

This study examined the following research question: what is the relationship between micro-scale, built environment features of neighborhoods and walking among adults? As noted earlier, data were initially collected as part of an evaluation of the California SR2S building construction program. The California SR2S program was authorized by Assembly Bill (AB) 1475 in 1999 and reauthorized by Senate Bill (SB) 10 in 2001. The program provides funding for construction projects near schools, with the intent of increasing pedestrian and bicyclist safety and improving the environment for active transportation to and from school (e.g., crosswalks, bike lanes, etc.) Data collection was designed for the purposes of evaluating that program.[5] At the same time, we were able to collect data to allow us to examine adult walking patterns in the neighborhoods being evaluated. Data collection was organized by schools, with neighborhoods defined as the 1/4 mile areas surrounding each school in the study. These procedures are described below.

Study Sites

As of Fall, 2003, the California SR2S program had completed three application cycles and approved funding for more than 270 projects. The 11 neighborhoods in this study each were identified by having an elementary school that was a participant in the SR2S program.

[5] For a full description and evaluation of the California SR2S program, see Boarnet et al (2005a) and Boarnet et al (2005b).

Neighborhoods in this study are listed in Table 1. For a description of school site selection and other details of the SR2S evaluation, see Boarnet, Anderson, Day, McMillan and Alfonzo (2005a) and Boarnet, Day, Anderson, McMillan and Alfonzo (2005b).

<<Insert Table 1 about here>>

Data Collection

Three types of data were collected at each school: (1) observations of built environment features within a quarter-mile of the school, using a detailed urban design audit instrument developed as part of the evaluation, (2) a survey of parents of 3rd through 5th grade students, and (3) observations of traffic flows and pedestrian counts in the vicinity of the proposed SR2S project. Only the first two data sources, the urban design audit and the survey of parents, are used in this study. Full descriptions of all data collection methods are provided in Boarnet et al. (2005a) and in Boarnet el al. (2005b).

Urban design audit. Information was collected on the physical character of the neighborhood surrounding each school in the sample. We defined "neighborhood" as the sum of all blocks contained in part or whole within 1/4 mile of the primary school impacted by SR2S construction project being observed. Segments comprised the unit of analysis, with a segment defined as both facing sides of a street block. Each neighborhood includes a different total number of segments, depending on its street pattern. Number of segments ranged between 6 and 47. All segments in the neighborhood were observed.

The urban design audit tool was developed to observe built environment features in each neighborhood. The tool included elements of the built environment that were hypothesized in the literature to be related to walking activity, including features linked to accessibility, traffic safety (comfort), perceived safety from crime (safety), and pleasurability. Measures of accessibility included the presence of sidewalks, mixed use, and public spaces. Measures of traffic safety included the presence of sidewalks and bike lanes, block length, and street width. Measures of crime safety included the percent of houses with windows facing the street and absence of vacant lots or abandoned buildings. Measures of pleasurability included the presence of street trees and street furniture. The audit tool was two pages in length. A separate survey sheet was used for each segment. The audit tool was pilot tested by the research team in two neighborhoods. The tool was modified based on the results of the pilot study, to reduce the number of items and to clarify data collection instructions.

To observe built environment features, a lead member of the research team surveyed the neighborhood in advance, marking neighborhood boundaries, identifying segment boundaries, and numbering segments on a map. Data collection teams of 2–3 observers walked each segment within the neighborhood. Observers included the principal investigators, and a team of graduate and undergraduate research assistants, who were students in urban planning. Observers participated in a training session, where they reviewed a codebook for measuring each built environment feature. Observers completed a sample audit of one block before collecting data in the field.

Observers collected data working in teams of two. Data was collected independently by each observer in the team, with the exception of data on physical measurements of sidewalk width and street width of each segment. These data were collected together by both observers, using a rolling tape measure. Completion of the urban design audit took approximately 4 hours per neighborhood.

Survey of Parents on Walking Behavior. The sample for the parent survey consisted of all parents with children in the 3rd through 5th grade attending the school that was linked to each

SR2S traffic improvement in that neighborhood. Sample sizes varied across schools based on the number of children in each grade. The survey collected information on the parent's self-report of the child's method of travel to and from school, and the parent's own walking and bicycling in the neighborhood. The survey asked parents about their perceptions of driving behavior around school, their perceptions of safety and crime near school, and their attitudes towards walking and bicycling to school. In terms of the parent's own walking, the survey asked about the number of trips he or she completed in the previous week that were at least 10 minutes in length. Questions also asked about the purpose of each walking trip. Additional questions asked about the location of parents' walking (in or outside of the neighborhood), and the overall amount of time spent walking.

Additionally, the survey asked each parent to mark the location of his or her home on a map of the neighborhood. Maps were divided into four quadrants, with the school at the center. Parents could also indicate if their homes were not located on the map. Finally, the survey collected basic demographic information.

The survey was administered in English and Spanish and designed for completion in approximately 15 minutes. The survey was distributed in the classroom to be sent home and returned through the student. There was no follow-up to capture those who did not respond. Surveys were distributed and collected by teachers for students to take home for their parents to complete. All surveys were anonymous. No information was collected on the identities of those who completed surveys. We did not follow up with nonresponders because of the burden that would have created for teachers to monitor parents' completion of the survey and to selectively follow up with parents who had not responded. At the 11 schools in this study, a total of 1297 parents completed the "after" survey, representing an overall response rate of 38.59%.

<u>Survey</u>

The survey asked parents of 3rd through 5th grade children a battery of questions about their child's travel to school and parental attitudes and demographic characteristics. The survey also asked the parent respondent about their own walking, and those are the data that we use here. The survey asked parents to list the number of walks they make in a typical week, breaking down number of walks by the following purposes (with the language drawn from the survey):

walking my dog (or other pet)

walking to a park, playground, or community pool

walking to a store or restaurant in my neighborhood

walking to a store or restaurant near my work

walking to my work

walking my child to school

just walking for leisure or exercise around my neighborhood

walking for other purposes (not listed above)

The survey question asked parents to only count their walks that were typically longer than 10 minutes, eliminating short incidental walks of less than 10 minutes. Of the above walking trip purposes, walks "to a store or restaurant near my work" was excluded from the analysis in this paper, as the research here focuses on the link between the built environment near a person's residence and the walking within their neighborhood. In a separate survey question, respondents were asked to estimate the fraction of their total walking that was within their neighborhood of residence, and the results showed for survey respondents, the majority of their walking is within their neighborhood of residence. Among survey respondents, 56.5 percent said that they made three quarters of more of their walks in the neighborhood where they and lived, and 68.4 percent said they made more than half of their walks in the neighborhood where they lived.

From the responses for the trips purposes listed above, we formed three variables:

Total Walking: The number of typical weekly walking trips for all purposes excluding "walking to a store or restaurant near my work."

Destination Walking: Walking to a (1) park, playground, or community pool, (2) store or restaurant, (3) work, or (4) child's school.

Recreation Walking: Walking (1) to walk a dog or pet, or (2) for leisure or exercise.

These three variables above are the focus of the analysis. The urban design variables were obtained from the urban design inventory described earlier. Urban design variables were grouped into four indices: (1) Accessibility, (2) Safety (from crime), (3) Comfort (traffic safety features), and (4) Pleasurability (those features making walking pleasant or enjoyable). The formation of these indices was guided by the literature (see Alfonzo, 2005). All indices were calculated by adding the percentage of blocks within the quadrants with X urban design features present (or absent). In the case of street widths, block lengths, and sidewalk widths, a cut point was identified for each[6]. Those segments that met those cut points contributed one "point" to the overall index. Table 2 shows the urban design components for each index.

<<Insert Table 2 about here >>

Results

Following past practice in studies of walking travel, we regressed each of our dependent variables (Total Walking, Destination Walking, and Recreation Walking) on the individual's socio-demographic variables plus the urban design indices for the quadrant where they lived. The indices were entered in turn, so that the results in Tables 5-7 show the effect of adding to the independent variable list first the accessibility index, then the safety index, then the comfort index, then the pleasurability index. The regressions generally followed the format shown below:

<measure of walking> regressed on <vector of sociodemographic variables> and <vector of urban design variables>

The data are for individuals, with walking measured three ways – total, destination, and recreation walking trips. The individual sociodemographic variables were weekly hours of work for the survey respondent, number of cars in the household, household income, time lived in neighborhood in years, dummy for marital status, number of children in the household less than 5 years old, number of children in the household between 6 and 11 years, number of children in

[6] The cut points were determined by the design literature. They were as follows: street width <36 ft; block length <500ft; sidewalk width >5ft

the household between 12 and 16 years of age, dummy variable indicating whether the respondent works, and years of education of the respondent.[7]

The urban design variables are available for quadrants where the individuals live. Urban design data for all blocks within a ¼ mile radius of each school site were collected. This area was divided into four quadrants. Each quadrant represents about 1,367,784 sq ft. and has an average of about 7 segments per quadrant. The individual walking data are matched to urban design variables in the quadrants.

Descriptive statistics for the dependent and independent variables are reported in Table 3 and Table 4. Regression results are reported in Tables 5-7. Consider first the regression results for Total Walking. Total Walking is positively associated with both hours worked and the dummy variable for the respondent's employment status, negatively associated with the number of cars in the household, positively associated with longer residence in the neighborhood, and positively associated with the number of children in the household between 6 and 11 years of age. All of these results are significant at the 10 percent level or better in Table 5. The coefficients on the income variables are not statistically significant in Table 5, but those coefficients are, in some cases, significant in other regressions (see Table 6 for destination walking). The pattern of the sign and significance on the socio-demographic variables is broadly stable for regressions for Total Walking, Destination Walking and Recreation walking throughout the analyses reported in this paper, with fewer socio-demographic variables factoring significantly for Recreation walking .

[7] The household annual income variable, self-reported by individuals as part of the survey, was measured for discrete categories: less than $15,000, $15,000 to $35, 000, $35,000 to $55,000, $55,000 to $75,000, and greater than $75,000. To capture quadratic income effects, the categorical variable that measures those five categories was squared, allowing income to be entered in quadratic form in the regression. (Both the categorical variable for income levels and the square of the categorical income variable were entered into the regression.)

<<Insert Tables 3 and 4 about here>>

We now turn our attention to the urban design variables.

For total walking (see Table 5), when you enter the accessibility index to the model with only socio-demographic variables, there is a marginal increase in the predictive power of the regression model (R^2 change = .005; p = .093). The accessibility index is marginally positively associated with total walking. When you enter the safety index into the regression along with accessibility, there is a significant increase in the predictive power of the regression model (R^2 change = .012; p = .009). The safety index is positively associated with total walking and the accessibility index is still marginally positively associated with total walking. When you enter the comfort index into the regression along with accessibility and safety, there is not a significant increase in the predictive power of the model (R^2 change = .002; p = .333), but the safety index remains positively associated with total walking. Finally, when you enter the pleasurability index into the model, there is again no increase in the predictive power of the overall model (R^2 change = .000; p = .855), but the safety index still remains positively associated with total walking.

<<Insert Table 5 about here>>

Looking only at destination walking (see Table 6), when you enter the accessibility index into the model with only socio-demographic variables, there is a significant increase in the predictive power of the model (R^2 change = .012; p = .008). Accessibility is positively associated with destination walking. When you enter the safety index into the model, there is a significant increase in the predictive power of the model (R^2 change = .009; p = .021). Both the safety index and the accessibility index are positively associated with destination walking. When you enter the comfort index into the model, there is not a significant increase in the predictive power of the model (R^2 change = .003; p = .218), but both the accessibility and safety indices remain positively associated with destination walking. Finally, when you add the pleasurability index into the model, there is not a significant increase in the predictive power of the model (R^2 change = .001; p = .530) and only the safety index remains positively associated with destination walking.

<<Insert Table 6 about here>>

For recreation walking (see Table 7), the only significant increase in the predictive power of the model comes when you enter the safety index to the model with the accessibility index and socio-demographic variables (R^2 change = .010; p = .023). The safety index is also the only index positively associated with recreation walking.

<<Insert Table 7 about here>>

Overall, the analyses presented here suggest that the some aspects of the built environment do impact adult walking. Urban design features related to both accessibility and safety affect the amount of walking that adults do in their neighborhoods. Areas with a higher percentage of blocks with sidewalks, mixed use, and public space have higher adult walking rates, than do those areas that have fewer of these physical design characteristics. Additionally, areas with a higher percentage of design elements related to perceived crime safety – including more windows facing the street and more street lighting; and fewer abandoned buildings, graffiti, rundown buildings, vacant lots, and undesirable land uses – have higher adult walking rates than do those areas in which these features are absent. Specifically, safety was important for recreation walking, and both accessibility and safety were important for destination walking.

Our findings lend specific support for three primary conclusions:

(1) Block-scale, micro, non-GIS built environment measures add explanatory power. These elements of the built environment, such as the presence of graffiti or street lighting, captured by on-site urban design audit instruments, are important in understanding individuals' decision to walk in their neighborhoods. Although the importance of GIS-based, more macro level data in predicting walking is not to be discounted (see Cervero (XXXX); Frank (XXXX) and others), these macro features do not tell the whole story in terms of explaining walking – particularly recreation walking (Handy, 1996). This finding lends support for the use of more recently developed audit instruments in future studies evaluating the effect of the built environment on walking (see Day, Boarnet, Alfonzo, & Forsyth, 2005).

(2) Grouping related built environment features into more comprehensive indices, provides some clarity as to how the built environment relates to walking. Overall, the results presented here are largely consistent with the model proposed by Alfonzo (2005). This study provides support for the assumption that separate characteristics of the built environment act together in influencing walking behavior. For example, an element such as a window that faces the street, may not individually matter for walking. The conjunction of several related features, however, such as the absence of rundown buildings, vacant lots, and graffiti, creates a composite environment supportive of walking behavior. Also, this study suggests that different aspects or sets of features of the built environment matter differently in terms of walking. These results warrant further testing of such a model that examines the relative impact of various built environment indices on predicting walking.

(3) Safety emerges as the most important built environment characteristic (of those tested), related to both destination and recreational walking. Though safety is often identified as a factor that could limit walking and other forms of physical activity, some studies find no or

limited impact of perceived safety or crime on physical activity levels (Huston, et al., 2003; Sallis et al., 1997). This finding may be explained by the use of a composite measure of environmental quality, which combines the impact of safety with that of other neighborhood characteristics, or by the small sample size and the limited number of individuals who perceived their neighborhoods as unsafe. Findings from our study lend further support to existing research that identifies an association between safety and physical activity (Centers for Disease Control and Prevention, 1999; Lee & Cubbin, 2002; Myers & Roth, 1997; Romero et al., 2001. In fact, our preliminary findings suggest that safety, especially tied to social disorder, may be one of the more important characteristics of the built environment, related to walking. Travel researchers do not typically examine built environment features linked to safety or social disorder (exceptions include Loukaitou-Sideris, 1999). Here, urban design researchers can make a valuable contribution to advancing our understanding of the key physical features that may matter for feelings of safety and hence impact walking.

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Table 1. List of neighborhoods examined

Alta Loma, California
Bell Gardens, California,
Chino, California
El Sobrante, California
Fontana, California
Glendale, California
Gonzales, California
Malibu, California
Murrieta, California
San Bernardino, California
Yucaipa, California

Table 2. Urban Design Indices for Walkability

Accessibility	Safety	Comfort	Pleasurability
Sidewalks	Windows facing the street	Sidewalk buffers	Street trees
Mixed use	Street lighting	Number of lanes	Street furniture
Public space	Abandoned buildings	Street width	
	Rundown buildings	Block length	
	Vacant buildings	Sidewalk width	
	Graffiti	Traffic circles	
	Undesirable land uses	Curb bulbouts	
		Speed bumps/humps	
		Medians	
		Paving treatment	

Table 3. Descriptive statistics for socio-demographic characteristics of survey respondents

	N	Min	Max	Mean	Std. Dev
Number of hours worked	1,075	0	84	27.86	19.36
Number of cars in the household	1,185	0	8	2.07	1.01
Household income (1: < 15,000; 2: 15,001-35,000; 3: 35,001-55,000; 4: 55,001-75,000; 5: >75,000)	1,134	1	5	2.89	1.39
Length of time in the neighborhood (1: <1yr; 2: 1-5yrs; 3: 6-10yrs; 4: >10yrs; 5: All my life)	1,233	1	5	2.60	1.09
Marital status	1,202	0	1	0.85	0.35
Number of people in household 5 and under	1,064	0	5	0.49	0.71
Number of people in household between 6 and 11	1,062	0	4	1.57	0.72
Number of people in household between 12 and 16	1,065	0	9	0.57	0.78
Employment status	1,112	0	1	0.71	0.45
Number of years of education	1,190	0	25	11.99	3.82
Valid N (listwise)	738				

Table 4. Descriptive statistics for walking trips taken by survey respondents

Descriptive Statistics

	N	Min	Max	Mean	Std. Dev
Total destination walking trips per week	1,297	0	35	2.61	4.56
Walk to a bus stop	1,297	0	20	0.28	1.34
Walk to a playground or park	1,297	0	10	0.44	1.16
Walk to school	1,297	0	20	1.04	2.72
Walk to a store in your neighborhood	1,297	0	15	0.65	1.66
Walk to work	1,297	0	12	0.19	1.11
Total recreation walking trips per week	1,297	0	35	1.95	3.54
Walk for exercise	1,297	0	23	0.90	1.95
Walk for leisure	1,297	0	20	0.61	1.53
To walk a pet	1,297	0	20	0.44	1.61
Walk for other purposes	1,297	0	10	0.62	1.61
Total walking in your neighborhood	1,297	0	59	5.18	6.77
Walk to a store near your work	1,297	0	10	0.31	1.16
Valid N (listwise)	1,297				

Table 5. Regression results for total walking

Total Walking	Socio-demographics			Sociodemographics and Accessibility			Sociodemographics, Accessibility, and Safety			Sociodemographics, Accessibility, Safety, and Comfort			Sociodemographics, Accessibility, Safety, Comfort, and Pleasurability		
	B	t	p-value	B	t	p-value	B	t	p-value	B	t	p-value	B	t	p-value
Constant		0.594	0.553		0.135	0.892		-1.289	0.198		-1.214	0.225		-1.195	0.233
Number of hours worked	0.147	1.801	0.072	0.142	1.741	0.082	0.143	1.758	0.079	0.136	1.675	0.095	0.136	1.661	0.097
Number of cars in the household	-0.124	-2.556	0.011	-0.114	-2.345	0.019	-0.119	-2.448	0.015	-0.118	-2.431	0.015	-0.117	-2.403	0.017
Household income	-0.364	-1.544	0.123	-0.347	-1.473	0.141	-0.386	-1.644	0.101	-0.369	-1.566	0.118	-0.365	-1.541	0.124
Household income squared	0.322	1.386	0.166	0.315	1.361	0.174	0.334	1.451	0.147	0.323	1.398	0.163	0.319	1.379	0.169
Length of time in the neighborhood	0.094	2.127	0.034	0.088	1.985	0.048	0.080	1.811	0.071	0.075	1.703	0.089	0.075	1.676	0.094
Martial status	-0.026	-0.563	0.573	-0.025	-0.542	0.588	-0.028	-0.620	0.535	-0.024	-0.519	0.604	-0.023	-0.513	0.608
Number of people in household age 5 and under	-0.070	-1.556	0.120	-0.077	-1.703	0.089	-0.084	-1.867	0.062	-0.085	-1.885	0.060	-0.085	-1.863	0.063
Number of people in household between the age of 6 &11	0.164	3.743	0.000	0.164	3.762	0.000	0.164	3.773	0.000	0.166	3.821	0.000	0.167	3.822	0.000
Number of people in household between the age of 12 &16	-0.039	-0.901	0.368	-0.037	-0.851	0.395	-0.038	-0.877	0.381	-0.035	-0.811	0.417	-0.035	-0.801	0.424
Employment status	0.200	2.416	0.016	0.193	2.334	0.020	0.193	2.343	0.020	0.188	2.279	0.023	0.187	2.263	0.024
Years of education	-0.012	-0.240	0.811	0.007	0.126	0.900	0.009	0.173	0.863	0.010	0.189	0.850	0.010	0.189	0.850
Accessibility index				0.078	1.681	0.093	0.085	1.825	0.069	0.066	1.309	0.191	0.060	1.004	0.316
Safety index							0.113	2.626	0.009	0.122	2.767	0.006	0.119	2.590	0.010
Comfort index										-0.048	-0.968	0.333	-0.045	-0.838	0.402
Pleasurability index													0.012	0.182	0.855
Overall Model	N= 527; R^2 = .076; p<.001			N= 527; R^2 = .081; p < .001; R^2 change = .005; p = .093			N= 527; R^2 = .093; p < .001; R^2 change = .012; p = .009			N= 527; R^2 = .095; p < .001; R^2 change = .002; p = .333			N= 527; R^2 = .095; p < .001; R^2 change = .000; p = .855		

Table 6. Regression results for destination walking

Destination Walking	Socio-demographics			Sociodemographics and Accessibility			Sociodemographics, Accessibility, and Safety			Sociodemographics, Accessibility, Safety, and Comfort			Sociodemographics, Accessibility, Safety, Comfort, and Pleasurability		
	B	t	p-value	B	t	p-value	B	t	p-value	B	t	p-value	B	t	p-value
Constant		1.950	0.052		1.197	0.232		-0.225	0.822		-0.134	0.894		-0.083	0.934
Number of hours worked	0.153	1.945	0.052	0.145	1.857	0.064	0.146	1.871	0.062	0.138	1.768	0.078	0.135	1.729	0.084
Number of cars in the household	-0.159	-3.397	0.001	-0.144	-3.081	0.002	-0.148	-3.172	0.002	-0.147	-3.152	0.002	-0.144	-3.084	0.002
Household income	-0.532	-2.341	0.020	-0.506	-2.239	0.026	-0.539	-2.390	0.017	-0.518	-2.292	0.022	-0.505	-2.222	0.027
Household income squared	0.359	1.604	0.109	0.349	1.570	0.117	0.365	1.649	0.100	0.351	1.583	0.114	0.340	1.529	0.127
Length of time in the neighborhood	0.091	2.130	0.034	0.081	1.916	0.056	0.075	1.760	0.079	0.069	1.626	0.105	0.067	1.558	0.120
Martial status	-0.075	-1.705	0.089	-0.073	-1.679	0.094	-0.076	-1.752	0.080	-0.070	-1.619	0.106	-0.070	-1.599	0.111
Number of people in household age 5 and under	-0.038	-0.869	0.385	-0.048	-1.109	0.268	-0.054	-1.251	0.212	-0.055	-1.275	0.203	-0.053	-1.221	0.223
Number of people in household between the age of 6 &11	0.144	3.411	0.001	0.145	3.452	0.001	0.144	3.456	0.001	0.147	3.522	0.000	0.149	3.549	0.000
Number of people in household between the age of 12 &16	-0.012	-0.287	0.774	-0.009	-0.206	0.836	-0.009	-0.226	0.821	-0.006	-0.145	0.885	-0.005	-0.114	0.909
Employment status	0.189	2.367	0.018	0.178	2.246	0.025	0.178	2.251	0.025	0.172	2.173	0.030	0.169	2.134	0.033
Years of education	-0.071	-1.438	0.151	-0.042	-0.842	0.400	-0.040	-0.804	0.422	-0.039	-0.784	0.433	-0.039	-0.783	0.434
Accessibility index				0.119	2.665	0.008	0.124	2.794	0.005	0.101	2.102	0.036	0.082	1.432	0.153
Safety index							0.096	2.321	0.021	0.107	2.523	0.012	0.099	2.227	0.026
Comfort index										-0.059	-1.232	0.218	-0.047	-0.926	0.355
Pleasurability index													0.038	0.628	0.530
Overall Model	N= 527; R^2 = .143; p<.001			N= 527; R^2 = .154; p < .001; R^2 change = .012; p = .008			N= 527; R^2 = .163; p < .001; R^2 change = .009; p = .021			N= 527; R^2 = .166; p < .001; R^2 change = .003; p = .218			N= 527; R^2 = .166; p < .001; R^2 change = .001; p = .530		

Table 7. Regression results for recreation walking

Recreation Walking	Socio-demographics			Sociodemographics and Accessibility			Sociodemographics, Accessibility, and Safety			Sociodemographics, Accessibility, Safety, and Comfort			Sociodemographics, Accessibility, Safety, Comfort, and Pleasurability		
	B	t	p-value	B	B	t	p-value	t	p-value	B	t	p-value	B	t	p-value
Constant		-1.286	0.199		-1.231	0.219		-2.268	0.024		-2.164	0.031		-0.083	0.934
Number of hours worked	0.105	1.259	0.209	0.105	1.258	0.209	0.105	1.269	0.205	0.096	1.158	0.247	0.135	1.729	0.084
Number of cars in the household	-0.031	-0.627	0.531	-0.031	-0.626	0.531	-0.035	-0.707	0.480	-0.034	-0.685	0.494	-0.144	-3.084	0.002
Household income	-0.004	-0.018	0.985	-0.005	-0.020	0.984	-0.039	-0.164	0.870	-0.015	-0.062	0.951	-0.505	-2.222	0.027
Household income squared	0.104	0.440	0.660	0.104	0.440	0.660	0.121	0.514	0.607	0.104	0.443	0.658	0.340	1.529	0.127
Length of time in the neighborhood	0.036	0.811	0.418	0.037	0.810	0.418	0.029	0.654	0.513	0.023	0.513	0.608	0.067	1.558	0.120
Martial status	0.021	0.447	0.655	0.021	0.446	0.656	0.018	0.381	0.703	0.024	0.517	0.606	-0.070	-1.599	0.111
Number of people in household age 5 and under	-0.075	-1.625	0.105	-0.075	-1.614	0.107	-0.081	-1.755	0.080	-0.082	-1.782	0.075	-0.053	-1.221	0.223
Number of people in household between the age of 6 &11	0.119	2.684	0.008	0.119	2.681	0.008	0.119	2.683	0.008	0.122	2.757	0.006	0.149	3.549	0.000
Number of people in household between the age of 12 &16	-0.047	-1.059	0.290	-0.047	-1.059	0.290	-0.048	-1.082	0.280	-0.044	-0.992	0.322	-0.005	-0.114	0.909
Employment status	0.164	1.953	0.051	0.165	1.951	0.052	0.164	1.955	0.051	0.157	1.870	0.062	0.169	2.134	0.033
Years of education	0.059	1.140	0.255	0.059	1.105	0.270	0.061	1.149	0.251	0.062	1.173	0.241	-0.039	-0.783	0.434
Accessibility index				-0.002	-0.035	0.972	0.004	0.085	0.933	-0.023	-0.445	0.657	0.082	1.432	0.153
Safety index							0.101	2.288	0.023	0.113	2.516	0.012	0.099	2.227	0.026
Comfort index										-0.068	-1.353	0.177	-0.047	-0.926	0.355
Pleasurability index													0.038	0.628	0.530
Overall Model	N= 527; R^2 = .044; p = .014			N= 527; R^2 = .044; p = .023; R^2 change = .001; p = .972			N= 527; R^2 = .054; p = .007; R^2 change = .010; p = .023			N= 527; R^2 = .057; p = .006; R^2 change = .003; p = .177			N= 527; R^2 = .058; p = .009; R^2 change = .000; p = .717		