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Walking behavior in Istanbul: Individual attributes, neighborhood context and perceived safety

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Abstract
Walking, for both utilitarian and recreational purposes, is one of the most common physical activities and is an integral part of daily active living. The socio-ecological perspective suggest that built and social environments act together to influence walking behavior. This paper examines how neighborhood and micro-environment safety contexts are associated with utilitarian and recreational walking. Data for this study were obtained from a large quality of life study conducted in metro Istanbul (1635 face-to-face interviews). The results show that utilitarian and recreational walking are influenced by perceived neighborhood safety and signs of territorial functioning (maintenance) in the immediate context. In addition, busy places and an assessment of the area as a good place to walk encourage both types of walking. Several, differences are found, however. The differences between the factors influencing the two types of walking behavior relate to a number of individual attributes and neighborhood social networks, neighborhood density, number of cars in the household, and the overall satisfaction with living in the area. Overall, these findings indicate that the concept of "walking" should not be considered a uni-dimensional construct, but rather there seems to be types of walking behavior, with different "causes" associated with those types. Implications of the research are drawn for possible policy to encourage types of walking behavior.

***Keywords**:*

Introduction

A rapidly expanding body of literature in transportation, urban planning, and public health has emphasized the relationship between built environment and physical activity behavior. At the same time, scientific literature has long established the causal connection between physical activity and health, as articulated in the U.S. Surgeon General's first report on Physical Activity and Health in 1996 (U.S. Department of Health and Human Services, 1996).

Physical activity has been related to improved health and quality of life and a reduction in the risk for several leading causes of death. Moreover, regular physical activity reduces the risk of developing several leading chronic illnesses, including cardiovascular disease (e.g., heart attacks, strokes), colon cancer, and non-insulin-dependent diabetes, as well as their precursors (e.g., high blood pressure, hypertension). In addition, it is also accepted that physical activity in concert with nutrition, contributes to reducing overweight and obesity rates in the population.

Pubic health research recognizes four types of physical activity, including transportation or utilitarian, leisure time or recreational, household, and occupational (Transportation Research Board/Institute of Medicine, 2005). Walking, for both utilitarian and recreational purposes, is the most common physical activity outside of the household or workplace (Sallis & Kerr, 2006) and can be an integral part of daily active living (Leslie, et al., 2007). Utilitarian physical activity refers to walking or cycling in order to reach a destination, whereas recreational physical activity refers to physical activity that is performed during exercise, recreation, or any additional time other than that associated with one's regular job duties, occupation, or transportation[1] (U.S. Department of Health and Human Services, 1996). Both types of walking are of particular importance to urban planners and designers, since as part of daily activities, they most commonly occur within the neighborhood.

Research recognizes the role of built environment in encouraging or discouraging walking behavior. A body of research suggests that utilitarian walking is consistently associated with land use mix, street connectivity, and residential density, and that recreational walking is consistently associated with proximity of recreational facilities and aesthetics. However, those studies that have employed socio-ecological perspective (McLeroy, et al., 1988; Sallis, et al., 2006) suggest that built and social environments are likely to act together to influence walking behavior and physical activity in general. Of the many social environment characteristics that could be relevant to physical activity, built environment researchers have been most interested in crime safety (Sallis & Kerr, 2006). Perceived or objective danger from crime could negate benefits of activity-friendly built environments if people are too afraid to walk on the streets, go to the park, or visit their friends. However, the extant research evidence does not suggest consistent relationships between crime and physical activity. Additional research evidence is needed to show how safety concerns are associated with neighborhood based walking behavior.

In addition, most of the evidence for the connection between built and social environment and physical activity is based on the studies conducted in developed countries. However, the increase in obesity rates and decline in physical activity trends are worldwide phenomena (Monteiro, et al., 2004). For example, a recent study, found that Turkish population has higher obesity prevalence than most of the European countries (Işeri & Arslan, 2008). For instance, the current study finds that 56% of Turkish population is overweight and 16% is obese. Since it is recognized that physical activity is a public health priority internationally (IPEN, 2009), in order to develop effective interventions research evidence from different countries is needed (Owen, et al., 2007).

The present effort contributes to this emerging literature by examining how perceived safety and social networking in one's neighborhood are associated with walking for utilitarian and recreational purposes. In addition, we examine a more micro-ecological set of measures, specifically, perceived physical and social disorder, as well as how busy the micro-context is, in relation to walking for utilitarian and recreational purposes, while controlling for individual and other contextual variables in Istanbul Metropolitan Area, Turkey. To our knowledge no research has examined the link between walking and built environment and safety neither in a Turkish context, nor the effect of both ecological and micro ecological factors simultaneously.

The reminder of the paper is organized as follows. First we provide an overview of the empirical findings linking neighborhood context and walking behavior. Second, the research design and methods utilized in this study are presented. Third, the study results are presented and discussed. The final section presents conclusions and implications for urban design and policy.

Neighborhood Context and Walking Behavior

A rapidly increasing body of literature relating built environment and walking behavior has emerged over the last two decades. This body of research suggests that activity-promoting features vary for utilitarian and recreational walking (Sallis & Kerr, 2006; Williams, 2007; Baran, et al., 2008). The research evidence indicates that utilitarian/travel walking is most commonly associated with mixed land use (Frank, et al., 2005), street connectivity (Boarnet & Crane, 2001; Frank, et al., 2005; Greenwald & Boarnet, 2000; Moudon, et al., 2006, Baran, et al., 2008), proximity to commercial and retail land uses (Cervero & Kockelman, 1997; Giles-Corti, et al., 2005; Giles-Corti & Donovan, 2002; Humpel, et al., 2002; Huston, et al., 2003; Frank, et al., 2005; Rodriguez, et al., 2006; Shay, et al., 2006; Moudon, et al., 2006; Lee & Moudon, 2006), and employment and population density (Cervero, 1996; Cervero & Wu, 1997; Messenger & Ewing, 1996; Frank, et al., 2005; Moudon, et al., 2006; Miles, et al., 2008). In contrast, recreational/leisure walking is consistently related to access to parks and trails (Hoehner, et al., 2005; Paxton, 2005) and aesthetics of recreation facilities and neighborhood in general (Burton, et al. 2005; McGinn, et al., 2007).

However, there is growing evidence that built environment acts together with social environment to influence physical activity. This recognition has resulted in increased interest in examining the role of social and community characteristics in encouraging physical activity. Of the many social and community issues that could be relevant to physical activity, crime safety appears as the most commonly studied concern. Nevertheless, the evidence from this body of research does not suggest a consistent relationship between safety from crime and physical activity and/or walking behavior. While some studies have shown significant associations between physical activity or walking and perceived safety (Weinstein, et al., 1999; Booth, et al., 2000; Giles-Corti & Donovan, 2002; Molnar, et al., 2004; Gomez, et al., 2004; Li et al., 2005; Suminski, et al., 2005) others have failed to support such relationships (King, et al., 2000; Wilcox, et al., 2000; De Bourdeaudhuij, et al., 2003; Addy, et. al., 2004; Miles, 2008).

Large-scale reviews on active living (Loukaitou-Sideris, 2004; Sallis & Kerr, 2006) have suggested that the inconsistent results related to crime and fear

of crime are mainly due to methodological weaknesses and inconsistencies that characterize the literature on the topic. These issues include utilization of crude measures of safety, use of composite measures that combines safety attributes with other physical and aesthetic characteristics of the neighborhood (Burton, et al., 2005; Giles-Corti & Donovan, 2002), and the use of objective (Zhu & Lee, 2008) versus perceived (Li, et al., 2005) measures of safety. Despite the mixed results, interest in crime safety is increasing, partially due to the fact that there are built environment strategies for reducing both actual and perceived crime (Crowe, 2000; Zelinka & Brennan, 2001).

In addition to safety from crime, researchers that are interested in the relationship between built /social environments and active living have been interested in other situational attributes. Among others, studies have examined the relationship between active living and social support (Giles-Corti & Donovan, 2002), collective efficacy (Roman & Chalfin, 2008), neighborhood social disorder (Ross & Mirosky, 2001; Molnar, et al., 2004), and physical disorder (Ross & Mirosky, 2001; Miles, 2008).

Building on the extant literature, this study aims at contributing to understanding relationships among perceived crime safety, neighborhood social networks, micro-ecological characteristics and walking behavior, while controlling for multiple individual and contextual variables. Although the researchers here generally favor the use of objective measures (Handy, 2004), the use of subjective measures in this study is justified by the fact that it is people's beliefs and perceptions that ultimately affect their behavior towards walking, biking, or exercising (Loukaitou-Sideris, 2004).

Research Design and Methods

Data for this study were obtained from the Measuring of the Quality of Urban Life in Istanbul study funded by the Strategic Planning unit at the Greater Istanbul Municipality and Istanbul Technical University Research Foundation. That project aimed residents' assessments of various dimensions of urban life, including safety and walking behavior, and was intended to provide knowledge base for developing planning and design strategies at metropolitan and neighborhood scales.

The sample for this project consisted of 2484 residents of metro Istanbul. The face-to-face interviews were administered between November 2006 and February 2007 and took place in respondents' homes. Because of the nature of the study, which required face-to-face interviewing, we adapted a three-stage cluster sampling strategy to select cluster beginning points, housing units, and respondents. The sampling strategy involved the following steps. First, in order to provide opportunity for comparison and adequate variation in contextual variables, we initially categorized all 740 wards ("mahalles") in Metropolitan Istanbul to one of the nine study cells, strata, defined by 3 x 3 table of low, medium, or high on mean land value and low, medium, and high on residential density. Comparable strategy has been employed in similar studies (Frank, et al., 2005). Second, in each sampling cell, an equal number of cluster beginning points were selected from the residential building entrances GIS database using a systematic random sampling with probability proportional to size; i.e., number of housing units in each building entrance, using SAS 9.1.3. Third, a fieldwork was carried out to check and finalize the list of dwelling units in each cluster. Fourth, in each cluster, a systematic random sampling strategy was used to select six housing units

for conducting interviews. Finally, from each housing unit, respondents were randomly selected using an objective method (Kish, 1949). To increase the response rate, if the selected respondent was not at home or was not available, two follow up visits were made. Overall, we obtained 1635 valid interviews and achieved a response rate of 66%, which is comparable to similar studies (Goyder, 1985). Analysis weights were constructed to adjust for number of adults in each sampling cell and for the unequal response rate between males and females. All statistical analysis incorporated these weights.

Conceptual framework

Grounded in previous literature, our conceptual framework recognizes that situational characteristics (factors immediately surrounding a location) create opportunities for crime and disorder. In turn crime and disorder produce fear (Perkins, et al., 1992), which may reduce physical activity. At the same time other factors, such as psychological, sociodemographic, environmental characteristics may influence the fear of crime and physical activity (Loukaitou-Sideris, 2006; Loukaitou-Sideris & Eck, 2007).

Guided by this framework, we test various hypotheses that variables are related systematically to utilitarian and recreational walking. In particular, we hypothesize that individual characteristics (such as age, gender, income, education, retirement status, and body mass index), as well as contextual characteristics (such as perceived safety and social networking) and micro-ecological level variables (such as social disorder, physical disorder, and perceptions that one lives in a "busy place") can affect the extent to which one has walked outside of the home recently to visit a friend, to shop, to visit a park or playground, or walk for exercise. Next we describe all the variables used in this study.

Dependent Variables – Walking behavior

Participants were asked about walking for four different purposes: "In the past week, have you walked to (each of the following): 1) visit a friend; 2) shop; 3) a playground/park; and 4) exercise around here?" Response options were coded as either no = 0 or yes = 1. Our analysis, include two dependent variables, utilitarian and recreational walking. Utilitarian walking refers to having walked to visit a friend or shop in the past week, while recreational walking refers to having walked to a playground/park or walked to exercise in the past week. For each of these types we consider three categories: no utilitarian walking; "One-Utilitarian Walking" refers to having walked to visit a friend or shop in the past week; "Two-Utilitarian Walking" refers to having done both in the past week; no recreational walking; "One-Recreational Walking" refers to having walked to a playground/park or walked to exercise in the past week; and "Two-Recreational Walking" refers to having done both in the past week.

Independent Variables

Individual-level variables.

Individual-level variables include gender, age, education, being retired, household income, and Body Mass Index (BMI). Gender was coded as dichotomous variable with "1" being male and zero female; age was measured in years as a continuous variable; education was measured on a six-point scale; being retired[2] was coded as a dummy variable; household

income was measured on a eight-point scale; and BMI was measured as a continuous variable (weight/height^{2,} in kilos and meters, respectively).

Contextual-level variables.
Participants indicated their opinions about safety in their neighborhood by their answers to the following five questions; How much crime there is in your neighborhood? How safe it is considered to go outside during day in this neighborhood? How safe it is considered to go outside at night in this neighborhood? How safe it is for women to go outside at night in this neighborhood? and How satisfied you are with the safety of this area? We developed an index of neighborhood safety (Cronbach's alpha .818) by summing up all five variables and dividing by 5. Since the items included in the index have different metrics, we standardized the variables before summing them up.

Neighborhood social interaction was measured with an index of perception of how much social interaction there is among neighbors. Following items formed the index of neighborhood social interaction (Cronbach's alpha .728): Number of relatives living in the neighborhood; Number of friends living in the neighborhood; Number of individuals known by name in the street or nearby area; Frequency of visiting those known in the neighborhood; and Frequency of doing favor with those known in the neighborhood, such as watching children, lending materials/tools, helping with shopping etc. Similar to the neighborhood safety, this index also was formed by summing up standardized variables and dividing by 5. We hypothesize that safe neighborhoods with relatively high levels of social interaction or social networking would seem conducive to walking behavior

We also account for micro-ecological level variables. Respondents were also asked to rate different attributes of the micro environment defined as what one sees from one's front door. These items were measured on a 7-point semantic differentiation scale. We performed factor analysis (promax) in which all of the different attributes of views from the front door were entered. Three factors emerged, which were included in the analysis as additive indexes (summed and divided by the number of items). The busy places index included four items: nosy, crowded, no trees/green, and heavy traffic (Cronbach's alpha = .774); the physical disorder index included two items: unmaintained houses and unmaintained yards and roads (Cronbach's alpha = .791); and the social disorder index included the following three items: no good neighbors, people not like me, and unfriendly people (Cronbach's alpha= .731). We assume busy places support walking, whereas physical disorder and social disorder, partly by producing fear, hinder walking.

Control variables.
We include a number of "control variables," which characterize: some additional neighborhood context variables, the respondent's household, and respondent's satisfaction. Two objective measures for the neighborhood context include density and land value. Density represents net residential density of neighborhood (mahalle) and was measured as a categorical variable (low, medium, high) using the Government Institute of Statistics data (TUIK, 2000). Land value was also measured as categorical variable based on the average land value for neighborhood (mahalle) using 2002 Ministry of Finance data (Maliye Bakanligi, 2002). In addition, the availability of public transportation in the area was coded as dichotomous variable and number of cars per household was coded as counts. Three types of

satisfaction variables were also included as control variables. Respondents were asked to indicate their satisfaction with: a) parks, playgrounds, and sport areas in the area, b) satisfaction with living in the neighborhood, and c) how good the place is for walking. The three types of satisfaction variables could be interpreted as representing intervening variables between the other individual and contextual variables and the dependent variables of walking behavior. That is, we think that some of the empirical association between such variables as neighborhood safety and walking could be mediated by one's satisfaction with the neighborhood, or with the playgrounds and parks in the area. Stated another way, perceptions of lack of safety may cause dissatisfaction with one's neighborhood, which, in turn, leads to less walking behavior.

Statistical Modeling

To examine the empirical relationship among the variables discussed above, we estimate models in which utilitarian and recreational walking behaviors are the dependent variables, and individual attributes, perceived safety, neighborhood social networks, micro-ecological level variables and other contextual and individual level variables (labeled "control" variables) are independent variables.

We applied multinomial logistic regression model to address the question of which variables increase or decrease the odds that someone will engage in utilitarian or recreational walking. We present the exponentiated regression parameter where a value of 1.0 represents zero greater likelihood of an outcome characteristic, given a one unit change in the independent variable. Thus, values above 1.0 represent an increase in the odds of the outcome, relative to being in the referent category of zero (i.e., the referent is no utilitarian walking or no recreational walking), and values below 1.0 represent a decrease in the odds of the outcome -- relative to the referent category of zero or no walking.

Descriptive Statistics

Table 1 reports the descriptive statistics for all the variables used in the regression analysis to follow. As can be seen in Table 1, males and females are evenly found in the sample. The average age of a respondent in the study is approximately 40, but some were as young as 18 and as old as 96. Retired people make up 16.3% of the sample. Respondent's average education is between "graduated from elementary school" and "graduated from high school" (mean=3.43). Average household income is between 1.000-1.500 YTL (mean = 3.17). The average BMI of a respondent is 25.24, which is the threshold for being overweight. Overall, 39.9% of the respondents are overweight (BMI =25.0-29.9) and 13% are obese (BMI≥30).

As for walking behavior, utilitarian walking is more common than recreational walking with 63.6% of the sample stating they have walked to visit a friend in the past week and 78.3% having walked to shop in the past week (56.3% have done both). Only 21.5% walked to a park or playground in the past week and 21.1% walked to exercise (only 10.2% have done both in the past week).

As for the distribution of safety, 21.5% of the sample describe their neighborhood as having high crime rates; 15.1% say it is not safe to walk in the daytime; 39.6% say it is not safe to walk at night and 78.1% say it is not

safe for women to walk alone at night in their neighborhood. The lowest value on neighborhood safety index is 1.63 standard deviations below the mean and the highest is 1.84 standard deviations above the mean.

Generally, there is a lot of variation across attributes of micro-contexts. For example, about 20% of the respondents report "quiet" and about 21% report "noisy" as attributes of the view from the front door with the median value being between 3 and 4 of the 7-point scale. Similarly, 22.4% see their view as crowded compared to 11.6% as uncrowded (with a median value of 4 on a 7-point scale).

As for density, 14.8% live in low density area (≤ 100 persons/hectare), 45.3% in medium, and 39.9% in high density area (> 300 persons/hectare). In terms of land values, 31.5% of the respondents live in low land value area (≤ 50 YTL); 43.6% in medium, and 24.9% in high land value area (> 150 YTL). Majority of the respondents (93.7%) state public transportation is available in their area. The average number of cars in an Istanbul household is .44.

As for satisfaction with the parks, playground and recreational facilities, 31.1% say they are "completely dissatisfied" with theirs, while only 4.9% say they are "very satisfied." In terms of satisfaction with living in the neighborhood 5.4% say they are "not satisfied at all" compared to 15.2% who are "very satisfied." Twelve and half percent of the respondents assess the neighborhood as a "no good at all" for walking, while 17.7% say "very good."

Table 1. *Descriptive statistics for dependent and independent variables (n=1635)*

	Mean or Percentage	Range	Standard Deviation
Dependent Variables			
Utilitarian walking	1.42	0-2	.73
Recreational walking	0.43	0-2	.67
Independent variables			
Individual-level variables			
Age	39.86	18-96	15.25
Male (%)	49.84	0-1	.50
Education	3.43	1-6	1.04
Retired (%)	16.27	0-1	.37
Household income	3.17	1-8	1.82
Body Mass Index (BMI)	25.24	14.69-58.59	
Contextual-level Variables			
Neighborhood Safety Index	0.00	-1.63-1.84	.76
Neighborhood Social Networks Index	0.00	-1.47-1.66	.69
View from front door: Busy place	4.34	1-7	1.65
View from front door: Physical disorder	4.14	1-7	1.80
View from front door: Social disorder	3.299	1-7	1.41
Control Variables			
Density (mahalle residential)	2.25	1-3	.70
Land value (mahalle average)	1.93	1-3	.75
Public transportation available	0.94	0-3	.24
Cars in household	0.44	1-5	.61
Satisfaction with parks, playgrounds etc.	3.10	1-7	1.90
Satisfaction with living here	4.83	1-7	1.64
Rate area as not a good place to walk	3.10	1-5	1.30

Results and Discussion

We estimated four separate regression models for each of the two walking outcome measures, utilitarian and recreational walking. The first model considers only individual-level independent variables, the second model includes both individual- and contextual-level variables, and the third model includes all the variables. The fourth model, labeled "reduced" model, includes only the independent variables that are significant predictors of outcome categories. The multinomial regression procedure produces separate estimates for the two measurement categories of the outcome variable, i.e. "One-Utilitarian Walking," "Two-Utilitarian Walking," in one equation. Similarly, "One-Recreational Walking," and "Two-Recreational Walking," are modeled in a single equation for recreational walking. No utilitarian walking or no recreational walking are used as referent categories in the two equations. Overall, we estimated 8 regression equations across Tables 2 and 3 below.

Utilitarian Walking

The results of the four models for utilitarian walking are shown in Table 2. In the analysis below we address the question of who is more likely to walk for utility purposes. The results of the analysis of individual-level variables alone (Model U-I), indicate that relative to not walking for utilitarian purposes in the past week, females are 68% more likely than males to say they walk either to a friend's home or to walk to shop – compared to not walking for these purposes. Females are 48.9% more likely than males to say they both walk to a friend's home and to walk to shop (compared to not walking for these purposes at all). The more educated respondents are more likely to report engaging in utilitarian walking in general, while those with higher incomes are less likely to engage in such walking. Older respondents also engage in less utilitarian walking. Retired individuals are more likely to say they walked to visit a friend and to shop in the past week (but not more likely to report just one or the other). BMI is not found to make a difference to utilitarian walking.[3]

In the second model (Model U-II), we include both individual- and contextual-level variables. Thus Model U-II of utilitarian walking adds to our understanding of what neighborhood and micro-environment contexts affect such behavior. The results of the model demonstrate that safe neighborhoods are associated with more utilitarian walking, as is social networks; 39% and 69% increases, respectively, in having done both types of utilitarian walking in the past week. We also found that busy places (noisy, crowded, no trees/green, heavy traffic) encourage utilitarian walking, while physical disorder (lack of maintenance) hinders it. Interestingly, our results show that social disorder, i.e., neighbors perceived as "not good neighbors," "not like me," and "unfriendly" as seen from one's front door, also supports utilitarian walking, one type or the other (to visit a friend or to shop), but not both.

In the third model, Model U-III, we also take into consideration other factors that may influence utilitarian walking. We refer to them as control variables. The introduction of control variables to the equation as shown in Model R-III has little effect on the parameters of the models already presented. The results of the full model indicate that neighborhood residential density encourages walking (30% increase having done both types of utilitarian

walking in the past week), while average land value in the neighborhood does not have effect on utilitarian walking. Availability of public transportation, number of cars in the household, and satisfaction with living in an area are not found to make a difference in utilitarian walking. An assessment of an area as not a good place to walk does discourage utilitarian walking, 20% reduction in having done both types of utilitarian walking in the past week. The results of the full model (Model U-III) show that even when various control variables are being included, the effects of individual- and contextual-level characteristics significant in the first (Model U-I) and the second models (Model U-II) do not change.

While we expected that some of the coefficients in Model U-II would go down in value when some of the control variables were entered into the equation (as in Model U-III), this was not found to be the case. Apparently the effects of the control variables are not mediating the effects of the individual and contextual variables, but have independent effects, at least in regards to utilitarian walking.

A reduced model (Model U-III Reduced), which included only the variables statistically significant for either type one or two utilitarian walking, was also examined. The results of this model are virtually the same as the full model, reinforcing its results. It is important to indicate that the statistically insignificant variables in Model U-III are not taking away substantially from the predictive strength of the other variables in the model.

Table 2. *Multinomial logistic regression models of utilitarian walking (n=1635[c])*

	Model U-I		Model U-II		Model U-III		Model U-III Reduced	
	One[a]	Two[b]	One	Two	One	Two	One	Two
Individual-Level								
Age	.98	.98*	.98	.98*	.98	.97*	.98	.98*
Female	1.68*	1.48*	1.63*	1.52*	1.77**	1.72**	1.63*	1.52*
Education	1.18	1.19	1.16	1.28*	1.20	1.32*	1.15	1.21
Being retired	1.35	2.88**	1.29	2.85**	1.36	2.92**	1.29	2.76**
Household income	.90	.90	.87*	.85**	.90	.90	.88*	.86**
Body Mass Index	1.01	1.03	1.01	1.03	1.02	1.04	-	-
Contextual Variables								
Neighborhood safety			1.13	1.39*	1.13	1.34*	1.11	1.34*
Neighborhood social networks			1.09	1.68**	1.12	1.74**	1.11	1.74**
View: Busy place			1.04	1.13	1.07	1.18*	1.06	1.17*
View: Physical disorder			.88	.85*	.90	.88	.91	.89
View: Social disorder			1.16	1.01	1.14	1.01	-	-
Control Variables								
Density					1.01	1.30	1.04	1.35*
Land value					1.03	.89	-	-
Public transportation available					.60	.72	-	-
Number of cars in household					.76	.65	-	-
Satisfaction with parks/playground					1.12*	1.03	1.11	1.02
Satisfaction with living here					.93	1.00	-	-
Not a good place to walk					.92	.79*	.94	.79*

***, ** and * denote significance at the .001, .01 and .05 levels of confidence respectively
a. One refers to having walked to visit a friend or to shop in the past week.
b. Two refers to having done both, i.e. walked to visit a friend and to shop in the past week.
c. Mean substitution was used for models with the BMI variable, which had 66 missing cases. A dummy variable representing "1" if missing on the original BMI index was included in all of the models except the reduced model, to control for any general characteristics associated with having a missing value on weight or height (used to calculate the BMI index). The coefficient representing this dummy variable effect is not statistically significant in any of the models and is not presented in the models (following the recommendations for handling missing data of Cohen & Cohen, 1983:292-297). Models were run with listwise deletion with results substantively the same as those presented here.

Overall, in terms of individual characteristics, the results suggest that there are gender differences in utilitarian walking, in favor of the female engaging in such walking more often than males, which supports some of the previous findings (Suminski, et al., 2005), but contradicts others (Owen, et al., 2007). It is possible to think that women are typically the primary shopper of the family (De Bourdeaudhuij, et al., 2003) and are more inclined to socialize with neighbors and friends. In addition, similar to previous research (Addy, et al., 2004), younger age and more education were associated with more walking. We also found that being retired enhances the likelihood of utilitarian walking, perhaps because of having more time to walk. On the other hand our results show that higher income discourages walking for utilitarian purposes, which is consistent with findings in a similar large-scale Australian study (Owen, et al., 2007). Interestingly, aging and retirement status have opposite effects. Contrary to our expectations, being overweight or obese has no effect on utilitarian walking.

Among the contextual-level attributes, perceptions of safety have strong effects on the chances of utilitarian walking, underscoring the importance of this variable for physical activity. Neighborhood social networks, not surprisingly, has the highest impact on utilitarian walking, since presumably visiting friends is more common where there such visiting is more prevalent generally. The availability of such networks increases the available destinations, i.e., visiting friends and neighbors, in the area. Research has also suggested that trust in neighbors too increases physical activity (Addy, et al., 2004).

Support is also found for two of the three hypotheses related to micro-level neighborhood attributes. Busy places (noisy, crowded, no trees/green, heavy traffic) support utilitarian walking, whereas physical disorder (lack of maintenance) discourages it. Busy places mean more street activity and street life, which has been seen as self-enforcing characteristics: the greater the level of street life, the more street life is encouraged (Handy, 1996). On the other hand, physical disorder, i.e., signs of territorial dysfunction (Perkins, et al., 1992), may increase fear of crime, which in turn reduces walking (Loukaitou-Sideris & Eck, 2007). Somewhat oddly, more "unfriendly" micro-neighborhoods, i.e., social disorder, result in more utilitarian walking of one type or the other (to visit friends or to shop), but not both. It is difficult to interpret the latter finding. Perhaps respondents who do not like their immediate neighbors are motivated to walk to see their friends rather than stay at home in an undesirable context. More research needs be done to refine our understanding of this phenomenon.

We also found that neighborhood residential density encourages utilitarian walking, supporting the most consistent finding in the travel literature (Frank, et al., 2005; Moudon, et al., 2006; Miles, et al., 2008). Although household income is associated with utilitarian walking, the neighborhood level land values do not have any effect on such walking. Surprisingly, neither availability of public transportation nor the number of cars in the household are associated with utilitarian walking. The fact that those with access to public transportation and to a car were not less likely to walk to shop or to visit a friend indicates that much of the utilitarian walking may have been by choice (Miles, et. al., 2008).

The only satisfaction variable that encourages utilitarian walking is satisfaction with parks, playgrounds and sport areas -- factors seemingly more relevant to recreational walking. Perhaps, in general, having more quality destinations in the area result in more walking (Handy, 1996; Miles, et al., 2008) for visiting friends and for shopping. Zlot and Schmid (2005) also suggest that parks might provide safe and accessible routes to shops or other locations, facilitating walking for utilitarian purposes. Interestingly, overall satisfaction with living in the area does not make a difference in utilitarian walking. However, as expected, an assessment of the area as not a good place to walk does discourage utilitarian walking, justifying further the importance of perceptions in decisions to walk (Loukaitou-Sideris, 2004).

Recreational Walking

The results of the four models for recreational walking are shown in Table 3. In the analysis below we address the question of who is more likely to walk for recreational purposes. In the first model, Model R-I, we find that gender

and age are unrelated to recreational walking, as is BMI. However, education is strongly related to recreational walking; with a one unit increase resulting in an increase of the odds by 26% and 57% for types one and two recreational walking, respectively. Household income increases the odds of only type one recreational walking, while retired individuals are 63% less likely to engage in both forms of recreational walking.

In Model R-II we add the contextual-level attributes to the equation. The results indicate that safety of the neighborhood affects the chances that a person will engage in type one recreational walking behavior, i.e., walked to visit a friend or to shop in the past week. The prevalence of social networks, however, does not make a difference to recreational walking. As for the more micro-environment variables, the view from one's front door as "busy" is not predictive of recreational walking, nor is the social disorder factor. Perceptions of physical disorder (lack of maintenance), however, does reduce the chances of both types of recreational walking.

The introduction of control variables to the equation as shown in Model R-III has little effect on the parameters of the model already presented. There are two exceptions to that general pattern. Busy places become statistically significant (11% increase in odds of type one recreational walking per unit increase in busy places index) and the view of physical disorder from one's front door becomes statistically insignificant for type one recreational walking. As for the control variables' effects, the number of cars in the household reduces the chances of both types of recreational walking by 32%. Satisfaction with parks/playgrounds and satisfaction with one's living area increase the chances of type one recreational walking by 7.5% and 10%, respectively. As expected, perceptions that where one lives is "not a good place to walk" decrease type two recreational walking by 42%. Neither neighborhood density, land value nor availability of public transportation affect the chances of engaging in recreational walking, net the effects of the other variables in the model.

Finally, in the reduced model for recreational walking (Model R-III Reduced), we observe two modifications to the full model (R-III) results. Satisfaction with parks/playgrounds becomes statistically insignificant for type one recreational walking. Whereas, an assessment of an area as not a good place to walk now becomes significant for both type one and type two recreational walking, i.e., it decreases both types of recreational walking (23% and 41%).

Table 3. *Multinomial logistic regression models of recreational walking (n=1635[c])*

	Model U-I		Model U-II		Model U-III		Model U-III Reduced	
	One[a]	Two[b]	One	Two	One	Two	One	Two
Individual-Level								
Age	1.008	1.000	1.006	.992	1.002	.988	---	---
Female	1.244	.771	1.245	.747	1.219	.768	---	---
Education	1.263 ***	1.566 ***	1.267 ***	1.446 ***	1.274 ***	1.476 ***	1.176 **	1.525 ***
Being retired	1.123	.368 ***	1.122	.337 ***	1.127	.321 ***	1.097	.386 ***
Household income	1.109 **	1.006	1.080 *	.962	1.099 *	1.001	1.088 *	1.040
Body Mass Index	1.013	1.008	1.013	1.012	1.016	1.018	---	---
Contextual Variables								
Neighborhood safety			1.285 **	1.192	1.201 *	1.138	1.221 *	1.121
Neighborhood social networks			1.187	.929	1.201	1.060	---	---
View: Busy place			1.041	.987	1.114 *	1.055	1.089 *	1.118
View: Physical disorder			.909 *	.774 ***	.953	.841 **	.953	.833 **
View: Social disorder			1.010	1.067	1.023	1.059	---	---
Control Variables								
Density					.890	1.322	---	---
Land value					.892	1.061	---	---
Public transportation available					.789	1.533	---	---
Number of cars in household					1.025	.679 *	1.040	.671 *
Satisfaction with parks/playground					1.075 *	1.060	---	---
Satisfaction with living here					1.104 *	.919	1.112 *	.923
Not a good place to walk					.897	.577 ***	.867 **	.591 ***

***, ** and * denote significance at the .001, .01 and .05 levels of confidence respectively
a. One refers to having walked to a park/playground or to exercise in the past week.
b. Two refers to having done both, i.e. walked to a park/playground and to exercise in the past week
c. Mean substitution was used for models with the BMI variable, which had 66 missing cases. A dummy variable representing "1" if missing on the original BMI index was included in all of the models except the reduced model, to control for any general characteristics associated with having a missing value on weight or height (used to calculate the BMI index).

Overall, in comparison to utilitarian walking, we found that different individual-level attributes play a role in recreational walking. Our results show that those with more education and higher income levels are more likely to engage in recreational walking. Perhaps educated individuals are more aware of health benefits of walking in general and are more engaged in walking for recreational purposes. Somewhat surprising, we found that gender, age, and BMI do not play role in recreational walking. Also, presumably the fact that being retired is negatively associated with recreational walking suggests that the retired generally refrain from such activities.

In terms of neighborhood attributes, we found that perceived neighborhood safety, busy places, and physical disorder are significant predictors of recreational walking. However, the prevalence of neighborhood social networks and micro-level social disorder do not make a difference for recreational walking. Residents who perceive their neighborhood to be safer are more likely to walk to a park/playground or to exercise, indicating that recreational walking in neighborhoods also could be impeded by fears for the perceived lack of personal safety. Similar results have been reported in a study conducted in Perth, Australia (Giles-Corti & Donovan, 2002). We also

found that busy places support recreational walking, while physical disorder around the house (unmaintained houses and yards/roads) discourages such walking. Overall, as previously suggested (Handy, 1996), these findings indicate that environment immediately surrounding the home is important in decisions to walk for recreation purposes.

As for the more general characteristics of the area, none of the neighborhood level objective measures (density and land value) affect the chances of engaging in recreational walking, nor is the availability of public transportation in the area. However, consistent with previous research (Giles-Corti & Donovan, 2002), we found that number of cars in the household is inversely related to recreational walking. This finding suggests that perhaps those that have access to car may choice to walk outside of their neighborhood.

Interestingly, all three perceptual characteristics introduced as control variables are significantly related to recreational walking. Satisfaction with parks/playgrounds and sport areas and overall satisfaction with living in the area support walking, although their effects are marginal. Moreover, the effect of satisfaction with parks/playgrounds and sport areas diminishes in the reduced model (Model R-III reduced). Likewise, in a national study, Zlot and Schmid (2005) also have found that recreational walking is not related to available parkland acreage. However, an assessment of the area as not a good place to walk does discourage recreational walking. These satisfaction variables could be seen as mediating or intervening between the individual and neighborhood context variables and the dependent variable (recreational walking). That is, it is reasonable to assume that some of the effect of neighborhood safety on walking behavior occurs through satisfaction with living in the neighborhood – the more perceived safety, the more satisfaction, which in turn results in more recreational walking. However, in terms of mediating effects, the satisfaction variables seem to have rather small mediating effects. For example, the effect of neighborhood safety on type one recreational walking is reduced from a 28.5% increase to a 20.1% increase per unit change in neighborhood safety when the control variables are introduced.

Conclusions

The results of this study confirm that it is important to distinguish between utilitarian and recreational walking. As suggested previously (Handy, 1996; Sallis & Kerr, 2006) different motivations and elements of neighborhood context play a role in an individual's decisions to walk for different purposes. These distinctions are particularly pronounced at the individual-level attributes. Our results indicate that females, younger and more educated individuals, and those who are retired are engaged in more utilitarian walking. On the other hand, those with more education and higher income levels are more likely to engage in recreational walking. While higher income is associated with decreased utilitarian walking, being retired is associated with decreased recreational walking. It is interesting that only those with more education exhibit more both utilitarian and recreational walking. It seems plausible that the perceived value of walking for utilitarian or for recreational purposes is more apparent to those who have completed higher levels of education. This indicates that there is value in strategies for

increasing awareness of health-related benefits of walking in early education.

The study findings also confirm that both the safety context of the neighborhood and safety context of the immediate area (what one sees from one's front door) are important for both utilitarian and recreational walking. Our findings suggest that perceived neighborhood safety and signs of territorial functioning (maintenance) in the immediate context have a supporting role in both types of walking behavior. Thus, a link is made between the literatures on neighborhood safety and health. These findings are also of particular importance to urban designers and planners, since they support the rationale for the development of built environment strategies for reducing both actual and perceived crime.

Our findings also indicate that busy places encourage both utilitarian and recreational walking. This seems surprising when items included in this construct are examined, i.e., noisy, crowded, no trees/green, and heavy traffic. However, at the same time, our findings show that an assessment of the area as not a good place to walk does discourage both types of walking, while satisfaction with parks and playgrounds, although marginally, supports both types of walking. These findings are relevant for urban planners and designers, since taken together, these results suggest that those places with more street activity and street life but also with more pleasant walking environment are supportive of both utilitarian and recreational walking. Attention to these built environment characteristics provides opportunities for encouraging active lifestyle and strengthening the overall quality of life.

The findings of this study have shown that the differences between the factors influencing the two types of walking behavior relate to neighborhood social networks, neighborhood density, number of cars in the household, and the overall satisfaction with living in the area. Both neighborhood social networks and neighborhood residential density have positive influences on utilitarian walking, while they do not make a difference to recreational walking. Also, while having more cars in the household reduces recreational walking, the number of cars in the household does not play a role in utilitarian walking. Finally, overall satisfaction with living in the area makes difference for recreational walking, but not for utilitarian walking.

In general, we can say that walking behavior is clearly not uni-dimensional, as utilitarian and recreational forms of walking seem associated quite differently with individual, social, and contextual attributes. Furthermore, individual, social, and contextual attributes are important to our understanding of why some people walk more than others. None alone is sufficient for our understanding of why people engage in walking behavior outside of the home.

Notes:

1. However, the distinctions among these categories are not always clear. For example walking to run an errand could be counted as both exercise and utilitarian travel (Handy, 1996; Transportation Research Board/Institute of Medicine, 2005).
2. Respondent's work status included the following categories: working, retired, unemployed, student, and housewife. For analysis purposes all were coded as a dummy variable. Only being retired was significantly associated with walking behavior.
3. In the analysis here we treat utilitarian walking as a uni-dimensional construct. However, it should be noted that this may not be entirely the

case. For example, in separate models (not presented here) walking to shop was more often an activity reported by those with higher BMI – which was not the case for walking to visit a friend. Generally, however, the results for walking to see a friend are similar to the results of walking to shop. We also tested the assumption of uni-dimensionality for recreational walking and found that the models were generally the same for each type of recreational walking.

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