Published in final edited form as:
J Aging Health. 2009 February ; 21(1): 155–171. doi:10.1177/0898264308328650.

Neighborhood Social Cohesion and Disorder in Relation to Walking in Community-Dwelling Older Adults: A Multi-Level Analysis

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Abstract

Objectives—To examine the role of neighborhood social conditions and walking in community-dwelling older adults.

Methods—A multi-level analysis of data from 4,317 older adults (mean age = 74.5; 73% black) from a geographically-defined urban community. Participants completed structured interviews including 14 questions on neighborhood conditions and self-reported walking. The neighborhood questions were summarized into individual-level measures of perceived neighborhood social cohesion and disorder. These measures were aggregated by neighborhood to construct neighborhood-level measures of social cohesion and disorder.

Results—Neighborhood-level disorder, but not social cohesion, was significantly associated with walking, independent individual-level neighborhood perceptions and other correlates of walking. Further adjustment for race weakened this association to a marginally significant level.

Discussion—Neighborhood conditions may shape walking behavior in older adults, especially conditions that reflect physical neglect or social threat. Promotion of walking behavior in older adults may require improvement of the safety and upkeep of the neighborhood environment.

Keywords

aging; neighborhood conditions; walking; physical activity; multi-level models

The benefits of regular physical activity are well established, and have been documented for health outcomes at all stages of life (Bouchard, Blair, & Haskell, 2007; U.S.Department of Human Services, 1996). Among older adults, regular physical activity is associated with a reduced risk in mortality and aging-related decline in physical and cognitive function (Boyle, Buchman, Wilson, Bienias, & Bennett, 2007; Kramer et al., 1999; Kushi et al., 1997; U.S.Department of Human Services, 1996). Walking is by far the most predominant mode of physical activity among older adults (McPhillips, Pellettera, Barrett-Connor, Wingard, & Criqui, 1989; U.S. Department of Human Services, 1996), and associated with beneficial health

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effects (Abbott et al., 2004; Simonsick, Guralnik, Volpato, Balfour, & Fried, 2005; Weuve et al., 2004). In addition, impairments in walking and overall mobility are thought to be a critical early stage of the disablement process in this population (Ferrucci et al., 2000; Lawrence & Jette, 1996; Simonsick et al., 2005).

There is a growing recognition that various aspects of the neighborhood environment may account for individual differences in physical activity (Brownson, Baker, Housemann, Brennan, & Bacak, 2001; Humpel, Owen, Iverson, Leslie, & Bauman, 2004. People's perceptions of the neighborhood, such as walkability, safety, and friendliness, have been found to be correlated with overall physical activity and walking (Ball, Bauman, Leslie, & Owen, 2001; Cerin, Saelens, Sallis, & Frank, 2006; Humpel et al., 2004; King et al., 2000; King et al., 2003; Owen, Humpel, Leslie, Bauman, & Sallis, 2004). Features of the built environment related to the design of the urban landscape and land use mix may also be associated with physical activity levels (Atkinson, Sallis, Saelens, Cain, & Black, 2005; Cervero & Duncan, 2003; De Bourdeaudhuij, Sallis, & Saelens, 2003; Frank, Saelens, Powell, & Chapman, 2007; Giles-Corti & Donovan, 2002; Pikora et al., 2006; Saelens, Sallis, & Frank, 2003). The degree to which neighborhood conditions affect physical activity and walking behavior in older adults is less well understood, despite the fact that such conditions may be more important in this population due to the tendency of older persons to increasingly restrict most daily activity to the immediate vicinity of their homes (Lawton, 1980; Satariano & McAuley, 2003). Several studies suggest that structural features of the built environment are correlated with walking in older adults, including housing and employment density, and proximity to businesses and recreational facilities (Li, Fisher, Brownson, & Bosworth, 2005; King et al., 2005). Other findings indicate that self-reported neighborhood qualities, such as perceived neighborhood 'walkability', safety, and access to walking destinations, are associated with more walking (King et al, 2000; King et al., 2003). However, the degree to which actual neighborhood social conditions affect individual walking behavior, independent of a person's own perceptions of these conditions, remains mostly unclear. Unlike studies focusing on the built environment, it is difficult to conceive of truly 'objective' measures of the social qualities of the neighborhood environment. Previous studies have generally relied on self-report information on social processes among neighbors and other neighborhood characteristics from individual residents, which are then summarized at the neighborhood-level to derive aggregate measures of neighborhood social conditions (e.g., Sampson, Raudenbush, & Earls, 1997; Sampson, Morenoff, & Gannon-Rowley, 2002). In one of the few studies using this approach in an older population, Fisher and colleagues found that neighborhood social cohesion was associated with differences in average walking behavior between neighborhoods, but the effect on individual differences in walking was not tested (Fisher et al., 2004).

The purpose of this study was to examine individual differences in walking behavior among community-dwelling older adults in relation to two features of the neighborhood environment, social cohesion and exchange, and neighborhood disorder. These features have been hypothesized to represent neighborhood-level social processes that account for the accumulation of health risks and risk behaviors in disadvantaged neighborhoods (Browning & Cagney, 2003; Sampson, et al, 1997; Sampson, et al., 2002). Social cohesion and exchange (hereafter social cohesion) represent mutual trust and solidarity among neighbors along with the extent of their supportive social connections, interactions and exchange-based behavior (Sampson et al., 1997). Socially cohesive neighborhoods may facilitate outdoor activity, and may be more attuned to the needs of potentially vulnerable residents. In contrast, neighborhood disorder refers to intimidating or threatening social conditions (e.g., lack of safety, presence of strangers) and visible signs of neglect or decay (e.g., trash and litter, crumbling sidewalks), which may discourage older persons from navigating neighborhood space.

Following previous research (Fisher et al., 2004; Sampson et al., 1997), we construct measures of neighborhood conditions by aggregating individual residents' perceptions of social cohesion and disorder by neighborhood. Using a multi-level analytic approach, we first test the association of neighborhood-level measures of social cohesion and disorder with walking, and then test whether these associations are independent of individual-level perceptions of neighborhood conditions. In doing so, we examine whether neighborhood conditions are associated with walking behavior net of a person's own perception of these conditions.

METHODS

Data come from the Chicago Neighborhood and Disability Study (CNDS), which is designed to examine the role of neighborhood factors in disability and related outcomes in older adults. CNDS is based on the Chicago Health and Aging Project (CHAP), which is a population-based study of Alzheimer's disease and other common chronic conditions in older adults (Bienias, Beckett, Bennett, Wilson, & Evans, 2003). CHAP is conducted in three adjacent neighborhoods in Chicago, which together encompass 82 census block groups within an area spanning 20 census tracts. The population was identified on the basis of a census of all study area residents, and every person aged 65 and older was invited to participate. Of the 7,813 eligible residents, 6,158 (78.9%) agreed. In-home baseline interviews were conducted from 1993 to 1997, followed by successive interview cycles at approximately three-year intervals. As of the third cycle (2000–2002), residents who had turned 65 since the inception of the study have also been invited to participate. Beginning in 2000, all participants are recontacted yearly by phone. The first yearly phone interview included a set of neighborhood questions. Data for the present analysis come from participants who completed a CHAP interview and the subsequent phone interview between January 1, 2000 and September 2, 2006 (N = 5,060). Both CHAP and CNDS were approved by the institutional review board of Rush University Medical Center, and all participants provided written informed consent.

Study Variables

The analysis included age (in years), sex, education, income, health status, years of residence in the neighborhood and time of year as individual-level control variables. Education was measured as years of schooling completed, and income as total current income in 10 categories, ranging from lowest, < $5,000/year to the highest, > $75,000/year. Health status was assessed on the basis of nine self-reported, physician-diagnosed chronic medical conditions, including myocardial infarction, cancer, hypertension, stroke, diabetes, thyroid disease, shingles, Parkinson's disease and hip fracture. Individual conditions were summed for a total score of medical conditions. Participants reported the number of years they had lived in the neighborhood. Time of year was grouped in three-month periods according to meteorological season.

Assessment of neighborhood conditions included a set of structured questions on specific neighborhood features and conditions derived from previous research (Balfour & Kaplan, 2002; Fisher et al., 2004; Sampson et al., 2002). Six items assessed a person's degree of social connectedness to others in the neighborhood (e.g., neighbors do you know by name; neighbors with whom you can have a friendly talk) and the degree of social interactions and exchange a person perceives among neighborhood residents in general (e.g., neighbors taking care of each other; neighbors and friends talking outside). Seven items assessed the degree to which a person perceived problems related to safety and signs of physical neglect in the neighborhood (e.g., poor sidewalks and broken curbs; vandalism). Responses to each question were z-scored and averaged across questions to create individual-level summary measures of perceived neighborhood social cohesion and disorder. Cronbach's alpha's were 0.71, and 0.91 for social cohesion and disorder, respectively.

Neighborhood-level measures of social cohesion and disorder were constructed by averaging the corresponding individual-level measures by neighborhood. Given the lack of specific criteria of what constitutes a neighborhood, most research to date has relied on administratively-defined geographic boundaries, such as census tract or postal zip codes. The high density of participants in the CHAP study area made it possible to define neighborhoods by census block group. Although admittedly also a somewhat crude and arbitrary definition of neighborhood, census block groups are considerably smaller and tend to be much more homogeneous than larger neighborhood areas, such as census tract or zip code (Krieger et al., 2002). The reliability coefficients for the resulting neighborhood-level measures were computed using the approach described by O'Brien (O'Brien, 1990), which resulted in reliability coefficients of .78 and .85 for social cohesion and disorder, respectively. The neighborhood-level measures of social cohesion and disorder were negatively correlated ($r = -0.44$), but the corresponding individual-level measures were essentially uncorrelated with each another ($r = 0.02$).

Walking was based on questions derived from the 1985 Health Interview Survey (McPhillips et al., 1989), which assess the frequency of walking for exercise during the last 2 weeks and the typical duration at each occasion. To obtain a more complete picture of walking behavior in older adults, a second question was added that queried about walking for all other purposes (e.g., to go to the store or to visit someone). The total minutes of walking was computed for each type, and then summed to create a measure of total walking. The two individual walking variables were modestly correlated ($r = 0.29$). For the multi-level analysis, we used a square-root transformation to obtain a variable with an approximately Normal distribution.

Statistical Analysis

Multi-level regression models were used to test the association of neighborhood-level social cohesion and disorder with walking. Individual-level data were considered nested within neighborhoods defined by census block groups, and models were specified with a random intercept to account for the heterogeneity in walking between neighborhoods. In the primary analysis, the association between each neighborhood variable and walking was tested after adjustment for individual-level correlates of walking in older adults: age, sex, education, income, marital status, years of residence in the neighborhood, medical conditions, and season. In a preliminary analysis, all two-way interactions between the control variables were tested. One was found to be significant, between income and age, and retained in the primary models. Next, the corresponding individual-level neighborhood variable was added to test whether neighborhood-level social cohesion or disorder were associated with walking independent of individual-level perceptions of these conditions.

Three additional issues were addressed in secondary analysis. First, the primary models were repeated with race as an additional covariate to see whether the association of neighborhood conditions with walking was modified after adjustment for race. Race was not included in the primary model because of the complex inter-relationships between racial background and neighborhood conditions in highly segregated urban areas such as Chicago. Race is likely to influence the association between neighborhood conditions and walking at many different levels, both at the individual and community level, raising the concern that adjustment for race controls for pathways that mediate the association between neighborhood conditions and health-related outcomes. Second, the primary models were repeated to examine the influence of the inability to walk. Mobility problems increase substantially in older age, and a significant proportion of older adults are unable to walk (Barnes & Schoenborn, 2003). However, a priori exclusion of non-walkers may lead to a misspecification of the relationship between neighborhood conditions and walking to the extent that these conditions have contributed to the loss in mobility. Non-walkers were therefore retained in the primary analysis. However,

the primary models were rerun in the subset of participants who were able to walk, defined as a self-report of being able to walk across a room without help. Third, the primary models were repeated for each walking question separately, to see if neighborhood variables had a differential association with walking for exercise and other walking. All analyses were conducted using the SAS® 9.1.3 statistical software (SAS Institute, 2004).

RESULTS

Of the 5,071 participants, 409 (8.1 %) were no longer living in the study area and were excluded from analysis. An additional 345 (7%) participants were excluded due to missing data for walking (n=31), income or education (n=280), or individual-level neighborhood variables (n=34), leaving 4,317 participants for analysis. Among these, the mean number of minutes walked during the past 2 weeks was 251 (SD = 416), or slightly over 4 hours, although the median was only 120 minutes (see Table 1). About 1 in 5 older adults (21%) reported no walking at all during the last 2 weeks. Participants were on average 74.5 years old and had 12.5 years of education. Thirty-nine percent were male, 73% were black, and about 27% reported an income of less than $15,000. Average duration of residence in the neighborhood was 32.9 years, with 63% having lived in the neighborhood > 30 years. The average number of participants per block group was 53. Median walking time was higher among younger participants, men, non-blacks, and those with higher education and income, and among long-term residents of the neighborhood.

In the primary analysis, neighborhood-level social cohesion was positively associated ($\hat{\beta}$ =2.25, p=.04) with walking (see Table 2). However, the association was reduced to a non-significant level ($\hat{\beta}$ =0.19, p=.86) after adjustment for individual-level social cohesion. Individual-level social cohesion itself was positively associated with walking ($\hat{\beta}$ =2.43, p<.001). Neighborhood-level disorder was negatively associated with walking ($\hat{\beta}$ = −2.29, p=.02). The association increased ($\hat{\beta}$ = −2.78, p=.004) after adjustment for individual-level neighborhood disorder, which itself showed a marginally significant, positive association with walking ($\hat{\beta}$ =0.53, p=.06).

In the secondary analyses (see Table 3), adjustment for race did not change the results for social cohesion, but reduced the effect for neighborhood-level disorder ($\hat{\beta}$ = −1.96, p=.08). We also tested the interaction effects of race with both individual- and neighborhood-level variables for social cohesion and disorder, but none of these approached statistical significance (all p's > .10). Restricting the analysis to persons able to walk did not change the results for either neighborhood-level social cohesion or disorder. Neighborhood-level social cohesion was not associated with walking for exercise or other forms of walking. Neighborhood-level disorder was not significantly associated with walking for exercise ($\hat{\beta}$ =−1.46, p=.08), but showed a significant positive association with other forms of walking ($\hat{\beta}$ = −2.35, p=.01).

DISCUSSION

There has been a growing interest in environmental features that are associated with walking, physical activity and other health behaviors (Brownson et al., 2001; Datta et al., 2006; Diez Roux, Merkin, Hannan, Jacobs, & Kiefe, 2003). To our knowledge, this is one of the first studies to investigate specific aspects of the overall neighborhood environment in relation to walking among older adults. The ability to walk is of critical importance to the overall health and well-being of older adults (Fisher & Li, 2004; Simonsick et al., 2005; Wong, Wong, Pang, Azizah, & Dass, 2003), and mobility limitations tend to predict future declines in health and functional abilities (Ferrucci et al., 2000; Lawrence et al., 1996; Simonsick et al., 2005; Weuve et al., 2004).

Older adults who live in more socially cohesive neighborhoods reported higher levels of walking, on average. However, the neighborhood-level effect due to social cohesion appeared attributable to individual residents' perceptions of neighborhood social cohesion. Individual perceptions of the neighborhood environment have been associated with walking in previous studies, which have focused on characteristics such as convenience, safety, and attractiveness (Ball et al., 2001; Cerin et al., 2006; Fisher et al., 2004; Humpel et al., 2004; King et al., 2000; King et al., 2003; Owen et al., 2004). Other findings suggest that neighborhood social cohesion are important to understanding walking behavior in older adults, but only to the extent that they affect differences in walking levels between neighborhoods, rather than individual-level differences in walking (Fisher et al., 2004). The present findings also fail to support an independent contextual effect of neighborhood social cohesion on individual-level walking. However, they may also be consistent with a more complex causal pathway, in which individual-level perceptions of neighborhood social cohesion mediate the impact of the neighborhood environment on individual walking behavior. Although this interpretation may have considerable appeal, it remains speculative, given the absence of information on how neighborhood social conditions may have shaped individual perceptions of these conditions over time.

Neighborhood disorder was associated with lower levels of walking. This finding is consistent with previous studies of adverse neighborhood conditions and functional health outcomes among older adults (Krause, 1996; Balfour & Kaplan, 2002; Schootman et al., 2006), although negative findings have been reported as well (Fisher et al., 2004). Using a multi-level analytic approach, we were able to disentangle the contextual neighborhood-level disorder effect from individual-level perceptions of neighborhood disorder. To our knowledge, this is the first study to suggest that signs of neglect and disorder in the neighborhood environment may deter older adults from walking, especially non-discretionary types of walking, independent of their own perceptions of the neighborhood environment. In fact, individual-level perceptions of disorder were not associated with walking.

The present findings add to a growing understanding of the environmental influences on walking, physical activity and other health behaviors (Brownson et al., 2001; Datta et al., 2006; Diez Roux et al., 2003). Previous research has focused primarily on features of the built environment, such as density of population and housing, land use mix, patterns of street connectivity, and access to recreational facilities (Atkinson et al., 2005; Cervero et al., 2003; De Bourdeaudhuij et al., 2003; Frank et al., 2007; Giles-Corti et al., 2002; Li et al., 2005; Pikora et al., 2006; Saelens et al., 2003). Our data suggest that walking behavior may not only depend on features of the built environment, but that the overall condition and appearance of the neighborhood environment may play a role as well, at least for older adults. Taken together, these findings suggest that modification of the built environment, in terms of both design and upkeep, may be an important component of a more integral approach towards promoting walking and other forms of outdoor activity in this population (Frank et al., 2007; Saelens et al., 2003).

Adjustment for race resulted in a considerable reduction of the association of neighborhood disorder with walking. Race is an important potential confounder of this relationship, given that older African-Americans in the U.S. tend to live in more disadvantaged neighborhoods, and also report substantially lower levels of physical activity, including walking (U.S.Department of Human Services, 1996). Due to the high degree of segregation in most American urban areas, racial background may also represent a complex but unmeasured set of contextual factors that mediate or interact with neighborhood social conditions to shape walking behavior throughout life. Merely controlling for race assumes that neighborhood conditions affect health-related processes "independent" of race. Proper interpretation of these race-adjusted effects may be difficult to the extent that this assumption is not warranted.

Although older adults may spend more time each day in their own neighborhood, their age may also account in part for the lack of more robust associations for neighborhood variables, especially social cohesion. Older adults tend to face a growing burden of chronic diseases that impair mobility which may attenuate neighborhood influences on walking (Picavet & van den Bos, 1997). In addition, the prevalence of walking in this population is low; about one fifth (21%) reported no walking at all, and the median walking time was one hour per week. Excluding the 10% of participants unable to walk across a room raised the median walking time to 140 minutes per week, but a re-analysis limited to participants who could walk did not change the findings. Environmental conditions may be especially important for discretionary forms of walking, such as walking for exercise (Bauman, Sallis, Dzewaltowski, & Owen, 2002; Brownson et al., 2001; Humpel et al., 2004), although there was little evidence for such a trend in our data. In fact, neighborhood disorder was significantly associated with other forms of walking only, possibly due to the fact that older adults may not necessarily use their own neighborhood environment to walk for exercise.

The study has several important limitations. Due to the cross-sectional nature of the analysis, the findings do not permit causal inferences about the relationship between aggregate-level or individual-level neighborhood measures and walking. Causal inferences are a serious challenge in neighborhood research more generally, due to the potentially endogenous nature of neighborhood features and characteristics of individual residents (Oakes, 2006). Healthier or physically active individuals may seek out neighborhoods with more favorable conditions, and also may be more vested in keeping their neighborhoods safe and attractive (Frank et al., 2007). In an attempt to account for this, we controlled for individual health status and duration of neighborhood residence, but neither of these factors affected the observed associations between neighborhood conditions and walking. Nevertheless, the relationship between residents' characteristics and neighborhood qualities is likely to involve complex, reciprocal interactions that develop over the course of many years, if not decades. Such relationships will normally be difficult to disentangle in studies of limited duration, even if they are prospective. Another limitation is the use of self-report information on physical activities which can be subject to considerable inaccuracy (Adams et al., 2005; Ferrari, Friedenreich, & Matthews, 2007). The degree to which misclassification in walking has affected the findings is difficult to ascertain, although if non-differential, it may have attenuated observed associations between neighborhood variables and walking. Furthermore, the study did not specifically ask participants where they walked when walking for exercise or for other types of walking. The degree to which walking occurred outside the perceived neighborhood boundaries may also have resulted in some attenuation of the relationship between neighborhood conditions and walking. It is possible that this may have been the case in particular for walking for exercise, as participants living in neighborhoods with more disorder may choose to do this type of walking outside of their own neighborhood. Another source of bias may have come from dependencies in measurement error due to the use of a common source of information on neighborhood conditions and walking behavior (same source bias) (Lash & Fink, 2003; Oakes, 2006). Although this bias may lead to an over-estimation of neighborhood effects, it is likely to be small in our data given the high number of participants per neighborhood. Finally, a common challenge in neighborhood research is the lack of specific criteria of what constitutes a neighborhood. Given the absence of formal criteria to define neighborhoods, most studies to date have relied on administrative criteria (Diez-Roux, 2001; Sampson et al., 2002). The degree to which such criteria differ from individual residents' perceptions of the neighborhood area that are relevant to walking behavior may reduce the reliability of the observed associations.

The study also has two notable strengths. First, the data came from a socio-economically and racially diverse population of community-dwelling older adults, which should enhance generalizability of the results. Second, the study contained a high density of participants within the same geographic area, which allowed us to test independent contextual neighborhood

effects with considerably greater efficiency compared with most previous neighborhood studies of health.

In conclusion, we found significant cross-sectional associations between specific neighborhood conditions and walking in a diverse, urban population of older adults. These associations were independent of key individual-level correlates of walking, and for neighborhood disorder, also independent of individual-level perceptions of neighborhood problems. More effective promotion of walking among older adults may depend not only on the design of the urban landscape, but also on ensuring the safety and maintenance of the neighborhood environment.

Acknowledgements

This research was supported by grants from the National Institute of Environmental Health Sciences (ES 10902) and the National Institute on Aging (AG 11101). The authors thanks Ms. Michelle Bos, Ms. Holly Hadden, Mr. Flavio Lamorticella, and Ms. Jennifer Tarpey for coordination of the study, Mr. George Dombrowski for data management, Ms. Hye-Jin Nicole Kim for statistical programming, and Dr. Jennifer Balfour for assistance with the development of the neighborhood questions.

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Table 1

Descriptive characteristics of the sample (N=4,317)

	Mean(SD)/%	Minutes walked past 2 weeks Median (iqr)[1]
Total walking (min/2 weeks)	281 (466)	120 (20–360)
Walking for exercise	125 (273)	0 (0–140)
Other walking	159 (339)	60 (0–140)
Proportion not walking	21%	
Age	74.5 (6.7)	
65–74	59%	148 (40–420)
75–84	33%	70 (0–280)
≥ 85	8%	15 (0–120)
Sex		
Male	39%	180 (50–460)
Female	61%	70 (5–280)
Race		
Black	73%	90 (10–340)
Non-black	27%	150 (40–420)
Marital Status		
Married	47%	140 (30–420)
Not married	53%	80 (5–280)
Education	12.5 (3.5)	
< 12 years	30%	65 (0–280)
12 years	28%	95 (15–320)
≥ 12 years	42%	150 (40–420)
Annual household income (%)		
< $15,000	25%	50 (0–200)
$15,000–29,999	40%	110 (20–360)
> $30,000	35%	180 (55–480)
Residence in neighborhood		
Mean (SD)	32.9 (12.5)	80 (0–350)
≤ 15 years	10%	120 (20–310)
16–30 years	27%	120 (20–390)
> 30 years	63%	
Number of participants per census block group (mean, range)	53 (13–133)	

[1] inter-quartile range

Table 2

Multi-level regression models of neighborhood conditions and walking (N=4,317)

	Social Cohesion		Neighborhood Disorder	
	Model 1	**Model 2**	**Model 1**	**Model 2**
Age	−0.43***	−0.38***	−0.49***	−0.49***
Sex (male)	3.36***	3.06***	2.66***	3.34***
Education (years)	0.19***	0.16**	0.17***	0.16**
Income	0.40***	0.38***	0.37***	0.38***
Age × income	−0.03***	−0.04**	−0.03***	−0.03***
Marital status (married)	−0.61	−0.70	−0.59	−0.58
Medical conditions	−1.26***	−1.25***	−1.25***	−1.26***
Years in neighborhood	0.03*	0.02	0.04**	0.03*
Neighborhood Variables				
Neighborhood-level Social Cohesion	2.25*	0.19		
Individual-level Social Cohesion		2.43***		
Neighborhood-level Disorder			−2.29*	−2.78**
Individual-level Disorder				0.53

* p<0.05

** p<.01

*** p<.001

Cell entries are coefficients from the multi-level regression models and represent the increase in the square-root of the total minutes of walking during the past 2 weeks associated with a one-unit increase in the independent variable. All coefficients are adjusted for calendar season

Table 3

Multi-level regression models of neighborhood conditions and walking for exercise and other walking

	Adjusted for race	Total walking among persons able to walk (N=3889)	Walking for exercise (N=4317)	Other walking (N=4,317)
Neighborhood-level Social Cohesion	−0.39	0.21	−0.56	1.00
Individual-level Social Cohesion	2.43***	2.05***	1.75***	1.33***
Neighborhood-level Disorder	−1.96	−2.69*	−1.46	−2.35*
Individual-level Disorder	0.54*	0.10	0.29	0.51*

* p<0.05

** p<.01

*** p<.001

1 Walking is modeled as the square-root of the total number of minutes walked for exercise and for other forms purposes during the past 2 weeks

Cell entries are coefficients from the multi-level regression models and represent the increase in the square-root of the total minutes of walking (walking for exercise or other walking) during the past 2 weeks associated with a one-unit increase in the independent variable

Coefficients are adjusted for age, sex, education, income, income × age, marital status, medical conditions, years of residence in neighborhood, and calendar season