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Neighborhood Walkability and Walking for Transport Among South Asians in the MASALA Study

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Abstract

Background—The neighborhood built environment can have a strong influence on physical activity levels, particularly walking for transport. In examining racial/ethnic differences in physical activity, one important and understudied group is South Asians. This study aims to describe the association between neighborhood walkability and walking for transport among South Asian men and women in the United States in the Mediators of Atherosclerosis in South Asians Living in America (MASALA) Study.

Methods—A cross-sectional study was conducted in 2014 using the baseline dataset of the MASALA study (N = 906). Mean age was 55 years old and 54% of the sample was male. Weekly minutes spent walking for transport was assessed using a questionnaire adapted from the Cross-Cultural Activity Participation Study. Neighborhood walkability was measured using Walk Score, a composite index of walkability.

Results—After adjusting for covariates, with each 10-point increase in Walk Score, South Asian American men engaged in 13 additional minutes per week of walking for transport ($P = .008$). No association was observed between walkability and walking for transport in South Asian American women.

Conclusions—Results provide new evidence for how the effects of environmental influences on walking for transport may vary between South Asian men and women.

Keywords

Walk Score; active transport; built environment; gender

Engaging in physical activity improves health and quality of life in a variety of ways.[1] More specifically, regular physical activity can delay mortality, lower risk of developing chronic diseases such as heart disease and type 2 diabetes, decrease risk of stroke and some forms of cancer, and improve bone health, cognitive function, and mental health.[2] Physical activity

also plays a critical role in mitigating the risk of cardiovascular disease.[3] Specific cardiovascular benefits of regular physical activity include increased cardiorespiratory fitness and healthier body mass and composition.[1,4] Only 1 in 5 adults in the United States (U.S.) currently meets the recommendations in the 2008 Physical Activity Guidelines.[5,6] When beginning a physical activity regimen, patients are often advised to begin by walking for transportation.[7,8] Incorporating walking for transportation to increase physical activity has been associated with lower bodyweight and healthier body composition in both men and women.[9]

Prior literature has suggested that levels of physical activity may vary by race/ethnicity, with white men and women engaging in more physical activity compared with men and women of other racial/ethnic groups.[10] In examining racial/ethnic differences in physical activity, one important and understudied group is South Asians (individuals from India, Pakistan, Nepal, Bangladesh, and Sri Lanka). South Asians comprise a quarter of the world's population and are the second fastest growing ethnic group in the U.S.[11] Compared with other racial/ethnic groups in the U.S., South Asian Americans have high rates of cardiovascular disease, and in California, South Asian Americans have the highest heart disease mortality of any racial/ethnic group.[12] In addition, South Asian Americans are less physically active than other racial/ethnic groups.[13]

Engaging in physical activity is influenced not only by individual choice, but also by interpersonal, community, and environmental factors.[14] In particular, a growing body of research has found associations between characteristics of the built environment, such as sidewalks or pedestrian crosswalks, and certain types of physical activity, including walking for transport.[15–18] A more supportive built environment therefore may potentially facilitate one's ability to achieve recommended levels of physical activity.[19,20]

Less is known, however, regarding whether associations between neighborhood and walking vary by race/ethnicity, or whether neighborhoods may contribute to racial/ethnic disparities in physical activity.[21–23] To date, no study has examined the relationship between neighborhood walkability and walking for transport among South Asian Americans. Since physical inactivity is an important risk factor for cardiovascular disease, understanding how neighborhood walkability may facilitate or hinder walking for transport among South Asian Americans is important to the ability to mitigate elevated incidence of cardiovascular disease among this group. The goal of this study is to understand the association between neighborhood walkability and walking for transport among South Asian American men and women.

Methods

Study Design

This study is a cross-sectional analysis of a community-based cohort of South Asian Americans without known cardiovascular disease (CVD) from the Mediators of Atherosclerosis in South Asians Living in America (MASALA) study. The MASALA study is a prospective cohort study that investigates subclinical CVD in South Asian men and women.[11] The MASALA study is a community-based sample of 906 men and women from

2 sites—the San Francisco Bay Area and Greater Chicago.[11] The MASALA study is modeled after the Multi-Ethnic Study of Atherosclerosis (MESA) study, with similar recruitment, eligibility criteria, clinical measures, and questionnaire.[11] To be eligible for the MASALA study, participants had to be of South Asian ancestry (defined as having at least 3 grandparents born in either India, Pakistan, Bangladesh, Nepal, or Sri Lanka), be between 40 and 84 years old, and have the ability to speak and/or read English, Hindi, or Urdu.[24] Similar to the MESA study, the MASALA study used telephone-based recruiting from areas surrounding the clinical sites that had high proportions of South Asian residents, however, MASALA did not use a formal multistage probability sampling criteria as was done in MESA.[11] MASALA used exclusion criteria identical to that used in MESA, which included having a physician diagnosed heart attack, stroke or transient ischemic attack, heart failure, angina, use of nitroglycerin, or those with a history of cardiovascular procedures or any surgery on the heart or arteries.[24] In addition, those who were undergoing active cancer treatment or with current atrial fibrillation were also excluded.[24] Those with less than 5 years of life expectancy, those who planed to move out of the study region within 5 years, and those living in a nursing home or on a waiting list for one were also excluded.[11] Finally, those who weighed 300 lb (136 kg) or greater were excluded due to computed tomography scanner limitations.[11] The sociodemographic characteristics of the MASALA cohort are representative of other South Asians living in the U.S.[11]

The baseline examination of MASALA participants was conducted between October 2010 and March 2013.[11] The baseline examination assessed sociodemographic characteristics, lifestyle and psychosocial factors, standard CVD risk factors, oral glucose tolerance testing, electrocardiography, presence of microalbumin-uria, ankle and brachial blood pressures, carotid intima-media wall thickness using ultrasonography, coronary artery calcium, and abdominal visceral fat using computed tomography.[11] Participants are followed with annual telephone calls to identify CVD events, peripheral vascular disease, stroke, congestive heart failure, receipt of therapeutic interventions for CVD, and mortality.[11]

The institutional review boards of Northwestern University and the University of California, San Francisco approved the MASALA study protocol.[11] This study utilizes the full sample of participants enrolled in the MASALA study (N = 906). Mean age is 55 years old and 54% of the sample is male. Additional methodology regarding the MASALA study is described in detail elsewhere.[11]

Measures

Exposure: Neighborhood Walkability—Walk Score was used to assess neighborhood walkability. Walk Score is a global index of walkability that has been associated with walking in several prior studies and captures various aspects of the built environment's road metrics and pedestrian friendliness, including population density, distance to amenities such as restaurants, shopping, parks, schools, and entertainment, as well as street characteristics such as intersection density and block length.[17,25–27] Walk Score measures the walkability of an address by calculating walking routes to various places nearby and awarding points based on the distance to amenities in each category.[27] Possible values for Walk Score range from 0 to 100 and points are awarded using a decay function where amenities within a 0.25

miles (a 5 minute walk) are given maximum points and where no points are given when a distance is further than 30 minute walk.[27] Data sources for points incorporated in Walk Score calculations include Google, Education.com, Open Street Map, the U.S. Census, and Localeze.[27] Walk Scores of 0 to 24 indicate a very car-dependent neighborhood, where almost all errands require a car; Walk Scores of 25 to 49 indicate a car-dependent neighborhood, where most errands require a car; Walk Scores of 50 to 69 indicate a somewhat walkable neighborhood, where some errands can be accomplished without a car; Walk Scores of 70 to 89 indicate a very walkable neighborhood, where most errands can be accomplished without a car; Walk Scores of 90 to 100 indicate an extremely walkable neighborhood, where daily errands do not require a car.[27] Walk Scores are available for U.S. addresses through walkscore.com,[27] and were obtained for each MASALA participant based on his or her home address in June 2014. For this study, associated changes in physical activity were examined for 10-point increases in Walk Score.[17]

Outcome: Walking for Transport—Weekly minutes spent walking for transport was assessed using a detailed, semiqualitative questionnaire adapted from the Cross-Cultural Activity Participation Study.[28] Participants were asked to self-report whether they had engaged in a variety of physical activity behaviors in a typical week in the past month, how many days per week, and how long they had spent engaged in those behaviors each day.[28] The measure of walking for transport incorporates the time participants spent walking to get to places, such as a store, public transit, car, or workplace.[28]

Total physical activity in MET-minutes/week, which captures time participants spent engaged in general activities, leisure-time exercise, occupational, volunteer, and transportation activities was also examined as an outcome.[28] Each activity was matched to a MET value, which is the rate of energy expended during an activity to the rate of energy expended at rest,[4,29] and multiplied by the number of minutes that activity was performed in the week to find the MET-minutes/week that participants were engaged in physical activity.

Covariates

This study controlled for potential confounders of the relationship between neighborhood walkability and walking for transport.[17,30] These measures include participant sex (male or female), age (continuous), BMI (continuous), household income (< $40K, $40 to 75K, $75 to 100K, > $100K), and education (≤ High school, < Bachelor's degree, = Bachelor's degree, > Bachelor's degree). In addition, this study controlled for participants' recruitment site (the San Francisco Bay Area or Greater Chicago).

The impact of other potential confounders including participant religion, whether participants were born in the U.S., how long the participants had lived in the U.S., and perceptual variables, including self-rated health and perceived neighborhood safety were also examined. These additional adjustments had little impact on the observed associations between Walk Score and physical activity for either men or women. Further, these adjustments resulted in higher variance inflation factor (VIF) scores, suggesting that these additional variables potentially introduced multicollinearity instead of improving the model fit. The results of these models are not presented separately.

Analyses

Interaction between Walk Score and sex was significant ($P < .10$) and all analyses were stratified by sex. Mean and proportional differences in demographic and health-related factors between men and women were calculated using Student's t and Chi-square tests. For the multivariate analyses, a linear regression model was used to examine the association between Walk Score and minutes per week of transport walking.

Separate models were fitted for men and women. The final linear regressions stratified by sex examined the association between minutes per week spent walking for transport and Walk Score after adjusting for participant age, clinical site, BMI, household income, and education. All analyses were conducted using Stata 13.[31]

Results

Table 1 describes the distribution of characteristics of participants in the MASALA study overall, and stratified by sex. Compared with men, women were younger ($P = .004$), had attained lower levels of education ($P < .001$), and engaged in more minutes per week of walking for transport ($P = .021$). Similar proportions of men and women were born in the U.S., and the distribution of years lived in the U.S. was similar for both sexes.

In all models, a positive association was identified between Walk Score and minutes per week of walking for transport for men (Table 2). No association between Walk Score and minutes per week of walking for transport was identified for women in either the unadjusted or adjusted models. In the final model, adjusted for age, BMI, site, income, and education, each 10-point increase in Walk Score was associated with 13.2 additional minutes per week of walking for transport for men ($P = .008$).

A positive association was also identified between Walk Score and total physical activity in MET-min/week for men. No association between Walk Score and total physical activity in MET-min/week was identified for women in either the unadjusted or adjusted models. In the final model, adjusted for age, BMI, site, income, and education, each 10-point increase in Walk Score was associated with 162.7 additional MET-minutes/week of total physical activity for men ($P = .025$). These results are not presented separately.

Discussion

The goal of this study was to examine the association between neighborhood walkability and walking for transport among South Asian American men and women in the MASALA Study. An association was observed between walkability and walking for transport among men only. On average, men engaged in an additional 13 minutes per week of walking for transport with each 10-point increase in residential Walk Score, after adjusting for age, BMI, clinical site, education, and income. From a health perspective, 13 minutes of moderate paced walking burns approximately 70 kCal for a 175 lb male, which translates to 3640 kCal, or roughly a pound of body weight, over the course of a year. No association was observed between walkability and physical activity for women. Among South Asian Americans, the factors that influence walking for transport may be different for men than for

women, and neighborhood walkability may have a stronger influence on walking for transport in men than in women.

A growing body of literature has used Walk Score data in a public health context to investigate its association with walking. Various studies have validated the use of Walk Score as a measure of neighborhood walkability.[25,26,32,33] Multiple studies have identified positive associations between Walk Score and walking between Walk Score and walking.[17,34,35] In particular, one longitudinal study using Walk Score as a measure of walkability found that after moving to a more walkable neighborhood, individuals walked more for transport and weighed less than before their move.[36] Another study, however, observed no associations between Walk Score and walking in a sample of older adults.[37]

To the authors' knowledge, this is the first study that has investigated the association between neighborhood walkability as measured by Walk Score and walking for transport separately for men and women. Among studies that have used measures of walkability other than Walk Score, few have investigated the different effects that the built environment may have on walking for transport on men and women separately.[38] One study that examined the association between physical activity and neighborhood walkability using measures other than Walk Score identified sex differences in this association and found, similar to this study, that sex significantly moderated the relationship between the built environment and physical activity.[39] Similar to this study, Gebel and colleagues observed a stronger association between neighborhood walkability and physical activity for men than for women, however unlike this study, Gebel and colleagues observed a significant association between neighborhood walkability and physical activity for both men and women.[39] Another study found that neighborhood walkability had a stronger influence on walking for transport among women than among men, which directly contrasts with the findings presented in this study.[40] Among Asian Americans in particular, one study found that neighborhood factors did not explain low rates of walking, which also contrasts with the findings for South Asian American men presented in this study.[23]

Prior studies have identified differences in levels of physical activity and physical activity behaviors between men and women. Multiple studies have suggested that men tend to engage in higher levels of physical activity than women,[41,42] which contrasts with the findings of this study which found that on average, women in the study engaged in more minutes per week of walking for transport than did men. Among South Asians in particular, literature has suggested that gender differences in barriers to and motivations for engaging in physical activity may exist,[43,44] which could also contribute to the observed differences in associations between neighborhood walkability and walking for transport for men and women in this study. One study found that among South Asians, women more often reported a lack of time due to work and family and a lack of motivation as barriers to engaging in physical activity, while men more often reported climate as a barrier.[44] Thus, individual-level or cultural factors may have more of an influence on South Asian women's physical activity, while environmental factors may have more of an influence on South Asian men, which could explain the relationship observed between neighborhood walkability and physical activity in men but not in women.

This study is limited by the self-reported measure of walking for as well as the study's cross-sectional design. Because participants were not asked whether they chose to live in their neighborhoods for their walkability, there is the potential that this residential selection may lead to bias in this sample. In addition, participants in the MASALA study are South Asian Americans who are middle-aged or older and living in the Greater Chicago or Greater Bay Area, which limits the generalizability of this sample. This is a sample of South Asian Americans of high socioeconomic status, which generally reflects the larger population of South Asian Americans, but is likely not generalizable to lower-SES South Asian Americans or other racial/ethnic groups.[11] While this study adjusted for clinical site, the season in which measurements were taken was not available, which would likely affect walking for transport differently between the San Francisco Bay area and the Greater Chicago area. This study investigated 1 perceptual measure of neighborhood safety as a potential confounder of the relationship between Walk Score and walking for transport and did not find an association, however, this could be due to this sample having relatively high socioeconomic status and living in safe neighborhoods. Further, objective measures of neighborhood safety such as crime data were not available, and may influence the relationship between neighborhood Walk Score and walking for transport differently between men and women.[45] Finally, while global estimates of neighborhood walkability are widely used in the literature, using a global measure such as Walk Score renders it impossible for this study to identify the specific relevant environmental components that have the strongest influence on walking for transport and how these may vary for men and women. In addition, Walk Score uses open-source data from multiple sources that are updated on an ongoing basis to characterize walkability. Given this, certain locations may be updated more frequently than others, which may result in varying inaccuracies in Walk Scores based on location.[27]

This study has several strengths. First, the assessment of neighborhood walkability was based on the objective measure of Walk Score, rather than on perceptual subjective measurements, and prior literature has observed nonconcordance in perceived and objective measures of walkability.[46] This is important because it is likely that participants' perceptions of their neighborhood vary in ways that would affect their self-reported behavior.[47] This study's focus on South Asians living in America is also a strength as they are an understudied group at risk for low levels of physical activity; increasing physical activity through walking for transport among this population could be instrumental in better protecting their health.[48]

Because South Asians report the highest levels of overweight and obesity[49] and the lowest levels of physical activity[50] among Asians living in the U.S., it is critically important to develop a better understanding of the influences on walking behaviors in this population, and how these influences may differ between men and women. The findings presented in this study have important implications for future strategies aimed to increase physical activity and active transport among South Asian Americans. Efforts to improve the walkability of neighborhoods as a way to increase physical activity, such as the implementation of policies that encourage dense, mixed-use construction,[18] may encourage South Asian men to engage in additional physical activity. However, different strategies may be necessary to encourage more physical activity among South Asian women. Strategies that take into account sociocultural norms and family constraints, and that aim to increase the

South Asian American women's awareness of the benefits of physical activity may likely be more successful.[43] For example, strategies to encourage more physical activity among South Asian women might include a targeted education campaign, or offering women-only fitness classes in a trusted community center that South Asian women could attend with their children.[43]

Because of its public availability both nationally and internationally, Walk Score is a measure that future research should use to efficiently assess the association between neighborhood walkability and physical activity in a variety of populations. Future research should also aim to provide a better understanding of how influences on walking for transport may differ between South Asian men and women in the U.S. to inform interventions to increase physical activity in this population.

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Table 1

Descriptive Characteristics of Participants in MASALA Study

	Overall (N = 906)	Men (N = 486)	Women (N = 420)	*P*-value
Age (mean, SD)	55.32 ± 9.4	56.14 ± 9.9	54.37 ± 8.6	0.004
Clinical site (%)				
Northwestern University	45.3	49.0	41.0	0.016
University of California, San Francisco	54.8	51.0	59.1	
Born in the U.S. (%)	2.1	1.9	2.4	0.579
Years lived in the United States (%)				
0–10	5.9	5.2	6.59	0.098
11–20	25.4	24.7	26.1	
21–30	29.0	27.5	30.7	
31–40	27.3	28.9	25.4	
>40	12.5	13.6	11.2	
Highest educational attainment (%)				
Less than high school graduate	6.7	4.5	9.3	<0.001
High school graduate/GED	5.4	5.4	5.5	
Bachelor’s degree	28.8	25.3	32.9	
Higher than bachelor’s degree	59.1	64.8	52.4	
Family income (%)				
< $40,000	13.1	12.9	13.3	0.617
$40,000–$75,000	13.6	14.6	12.6	
$75,000–$100,000	10.1	9.1	11.3	
> $100,000	63.2	63.5	62.8	
BMI (mean, SD)	26.0 ± 4.3	25.9 ± 4.4	26.1 ± 4.2	0.547
Weekly minutes spent walking for transport (mean, SD)	122.88 ± 255.69	104.63 ± 223.88	1440.0 ± 287.00	0.021
Walk Score (mean, SD)	48.43 ± 22.46	49.04 ± 21.98	46.73 ± 21.98	0.387

Table 2

Change in Walking for Transport With 10-Point Increases in Walk Score (MET-min/week)

	Model 1 (Unadjusted)		Model 2 (Adjusted for age, BMI, site)		Model 3 (Adjusted for age, BMI, site, categorical education, categorical income)	
Walking for Transport (min/week)	**β (SE)**	***P*-value**	**β (SE)**	***P*-value**	**β (SE)**	***P*-value**
Males	16.28 (4.56)	<0.001	14.91 (4.66)	0.001	13.17 (4.92)	0.008
Females	2.57 (6.10)	0.674	3.38 (6.34)	0.594	3.64 (6.79)	0.611