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Associations of Neighborhood Factors and Activity Behaviors: The Mediators of Atherosclerosis in South Asians Living in America (MASALA) Study

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Abstract

Social and built environments may influence physical activity (PA). However, evidence from South Asian Americans (SAA), a group with low PA levels and high cardiometabolic risk, is lacking. We assessed the association between five neighborhood factors and PA behaviors in a community-based cohort of SAA. Data were from the Mediators of Atherosclerosis in South Asians Living in America (MASALA) Study 2010–13 (n=906). Adjusted multivariable models stratified by sex regressing PA behaviors on neighborhood factors were run. Higher neighborhood social cohesion was associated with 17% more PA MET minutes/week in men ($p<0.01$), but not in women. Having a park/playground near home was associated with meeting PA guidelines (odds ratio (95% CI): men: 3.14 (1.20–8.24); women: 3.67 (1.17–11.52)). Neighborhood factors were associated with favorable PA behaviors in SAA. PA interventions for SAA that increase neighborhood social cohesion or focus on linking individuals with local resources may be effective.

Keywords

community health; health behavior; neighborhood; environment; Asian/Pacific Islander; social determinants; PA/exercise; health disparities

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Conflicts of Interest

All authors declare that they have no conflict of interest

Introduction

Physical activity (PA) is a beneficial health behavior, associated with reduced risk of chronic disease. [1] Despite the benefits of PA, many people in the United States (U.S.) remain inactive. According to national data from the Health-Styles survey and the Behavioral Risk Factor Surveillance System (BRFSS), only 36.1% of adults were aware of the 2008 Physical Activity Guidelines for Americans [2] and only 22.9% of adults met the aerobic and muscle strengthening guidelines. Importantly, racial/ethnic minorities, including Asian Americans are less likely to exercise and are at greater risk for subsequent health consequences [3–7].

People of South Asian descent (India, Pakistan, Bangladesh, Nepal, Sri Lanka and Bhutan) are one of the fastest growing segments of the U.S. population, with current population estimates over 5 million [8]. South Asians in the U.S. have a significantly higher prevalence of type 2 diabetes mellitus (DM) than non-Hispanic Whites, Blacks, and Hispanics [9, 10]. While genetics may play a role in these racial/ethnic differences, physical inactivity is a key driver of South Asians' disproportionately higher cardiometabolic risk [11]. Cardiovascular disease is the leading cause of death in Asian Indians in the U.S., and stroke mortality rates have been increasing over time in this subgroup. Understanding the determinants of PA in this high-risk group is critical for developing effective interventions.

Neighborhood factors, such as neighborhood social cohesion or the features of the built environment such as walkability or the quality of parks and playgrounds, are increasingly recognized as meaningful determinants of PA [12, 13]. Neighborhood social cohesion refers to the perceived network of relationships, shared values and norms of a neighborhood. Neighborhood social cohesion may influence PA through increased social support or communication and reinforcement of social norms (positive or negative) around exercise and thus increased access to physical resources for exercise [14]. Social engagement – including neighborhood social cohesion has previously been shown to be associated with PA outcomes [15, 16]. Among older Asian American adults (55+ years) neighborhood social cohesion was associated with walking in Chinese older adults but not Filipino, Japanese, Korean or Vietnamese American adults [17]. South Asians were included in only one of the analyses– thus the current manuscript addresses this gap in the literature..

The objective of this analysis was to assess if neighborhood factors (neighborhood social cohesion, time living in neighborhood, feeling of safety, park/playground within walking distance of home, Walk Score) were associated with activity behaviors in a cross-sectional, community-based sample of South Asian Americans. A secondary objective of this paper was to identify if there were sex differences in these associations given differences in PA level, broadly [18, 19]. This paper fills important gaps in knowledge about the drivers of PA in the high risk, rapidly growing South Asian populations.

Methods

Study Design

This study is a secondary analysis of cross-sectional data on 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 community-based cohort of South Asian adults without known CVD, which was modeled on the Multi-Ethnic study of Atherosclerosis (MESA). Study participants were recruited from two clinical sites – the San Francisco Bay Area through the University of California, San Francisco (UCSF) and the greater Chicago area through Northwestern University (NWU). A total of 906 subjects were recruited and examined between October 2010 and March 2013. Detailed study methods have been previously published [20].

Participants

To be eligible for MASALA, participants had to be of South Asian ancestry and have at least three grandparents born in India, Pakistan, Bangladesh, Nepal, or Sri Lanka, be between the ages of 40–84 years, and be able to speak and/or read English, Hindi or Urdu. Exclusion criteria included having a physician-diagnosed heart attack, stroke or transient ischemic attack, heart failure, angina, use of nitroglycerin, a history of cardiovascular procedures, current atrial fibrillation, active treatment for cancer, life expectancy <5 years due to a serious medical illness, impaired cognitive ability, plans to move out of the study region in the next 5 years, living in or being on a waiting list for a nursing home, and weight >300 lbs.

Institutional Review Boards at UCSF and NWU approved of the MASALA Study protocol. This study utilized the full sample of participants enrolled in the MASALA study (N = 906). Mean age at baseline was 55 years old and 54% of the sample was male.

Primary exposures: neighborhood factors

The MASALA study included five questions on neighborhood social cohesion ($\alpha=0.65$), from an original scale developed by the Project on Human Development in Chicago Neighborhoods Community Survey [21]. Participants rated agreement/disagreement on a 5-point scale (scale: 1-strongly agree, 2-agree, 3-neutral, 4-disagree, 5-strongly disagree) with the following 5 statements: 1) People around here are willing to help their neighbors; 2) People in this neighborhood generally don't get along with each other; 3) People in this neighborhood can be trusted; 4) People in this neighborhood do not share the same values; and 5) Most people in this neighborhood know each other. Participant responses for questions 1, 3 and 5 were then reverse coded (e.g., strongly agree was assigned a value of 5 instead of 1), such that a higher value was associated with a more positive response to each statement. A neighborhood social cohesion score was constructed by summing the responses to the questions for a possible range of 5 to 25. Given the small magnitude of change that would be observed with a change in one unit of neighborhood social cohesion, the variable was categorized in tertiles (low, medium and high). Low social cohesion scores had a range from 8 to 17; medium from 18–20 and high from 21–25.

Other neighborhood factors, including time living in the neighborhood (years), perceived safety, having a park or playground within walking distance of home, and Walk Score [22] were also considered. Walk Score has been found to be a valid and reliable estimate of the availability and walkability to local resources for a given address. Walk score, varying between 0–100 and computed based on the distance to different weighted amenities (e.g.

shopping centers, schools, parks and restaurants), has been validated using objective GIS measures of neighborhood walkability [23].

Outcomes: activity behaviors variables

PA was assessed using a detailed, semi-qualitative questionnaire adapted from the Cross-Cultural Activity Participation Study [24]. A series of questions assessing light, moderate and heavy PA in different activity domains, including general activities (household chores, lawn/garden work, care of children or adults, walking, dance/sport activities), transportation, exercise, and leisure, occupational and/or volunteer activities were asked. The intensity (hours/minutes per day) and the frequency (number of days per week) were assessed for each domain and sub-category. The PA outcomes we assessed were: all PA in MET minutes/week; and meeting the 2008 PA guidelines with exercise (>500 MET minutes/week) [25].

Additional covariates

Acculturation and/or proxy measures of acculturation (e.g., years in U.S., nativity) have been previously shown to be associated with PA and was therefore considered a key covariate in this analysis [3, 5, 17, 26–28]. Acculturation was measured as years living in the U.S. and the traditional cultural beliefs scale ($\alpha=0.83$ for MASALA participants). This 7-item South Asian traditional cultural beliefs scale assessed to what extent participants believed the following behaviors should be practiced in America: (1) religious ceremonies or rituals, (2) consuming South Asians sweets during ceremonies, (3) the spiritual practice of fasting, (4) a joint family living structure, (5) arranged marriage practices, (6) consuming traditional ethnic foods, and (7) using traditional spices for health purposes. The scale included 5 response options ranging from absolute agreement to not agreeing at all with the 7 items. Scores had a possible range of 0–28, with lower scores reflecting stronger traditional cultural beliefs and higher scores reflecting weaker cultural beliefs [29]. Social support was assessed by the ENRICHD (Enhanced Recovery in Coronary Heart Disease) instrument. This six-item scale measures the range of emotional social support a subject has, with questions including: “Is there someone available to you who shows you love and affection?” and “Is there someone available to help you with daily chores?” The range of responses include: none of the time (1); a little of the time (2); some of the time (3); most of the time (4); all of the time (5). The overall score ranges from 6–30, with a score less than or equal to 18 indicative of the highest risk category for lack of social support (low vs. high) [30, 31]. All other characteristics including age, sex, household income and education were self-reported.

Statistical Analysis

All analyses were stratified by sex given differences in PA level [18, 19]. Demographic and other characteristics were assessed overall, and differences by sex were assessed using t-tests for continuous variables and chi-squared tests for categorical variables. Both continuous PA outcomes (PA in MET minutes/week) were log-transformed as they were non-normally distributed. Multivariable models regressing PA outcomes on neighborhood factors were run; logistic regression models were used for the binary outcome of meeting 2008 PA guidelines, and linear regression models were used for the continuous outcome of log-transformed PA MET minutes/week. Models were adjusted for study site, age, sex,

education, income, marital status, time in the U.S., traditional cultural beliefs score, and social support. Neighborhood factors were not found to be collinear with each other. STATA (version 12.0; College Station, Texas) was used for all analysis.

Results

The characteristics of MASALA participants are displayed in Table 1 (n=903). Mean age was 55.3 years, and 53.6% were men. A majority of the sample had a graduate degree (59.1%), household incomes of \$100,000 per year (63.2%), and were married (90.7%). Overall median neighborhood cohesion score was 18.5 and on average individuals had lived in their neighborhood for 14.2 years. The majority of participants always felt safe in their neighborhood (59.7%) or reported having a park or playground within walking distance of home (95.6%). Men and women differed with regards to some of these characteristics. Men tended to be slightly older; had a higher education level; were more likely to be married; and had lower PA MET min/week.

Multivariable regression models are presented in Tables 2, 3. The exponentiated regression coefficients for each variable included in the multivariable linear regression model with log-transformed PA MET minutes/week as the outcome variable are shown in Table 2.

The ratio of the expected geometric mean for high vs. low neighborhood social cohesion was 1.17 (95% CI 1.06, 1.29), or mean PA in MET minutes/week was 17% higher with high vs. low neighborhood social cohesion ($p<0.01$). Mean PA in MET minutes/week was 30% lower in men with more vs. less than high school degree; and 22% higher among men reporting a park, playground or open space within walking distance of home. Similar patterns were not observed in women. Moderate vs. low neighborhood social cohesion was associated with meeting PA guidelines in men (OR: 1.93, 95% CI 1.18, 3.17; Table 3). Having a park, playground or open space within walking distance of home was also associated with higher odds of meeting PA guidelines in both men and women (men OR: 3.14, 95% CI 1.20, 8.24; women OR: 3.67, 95% CI 1.17, 11.52). Higher education was strongly associated with meeting PA guidelines in men (graduate degree vs. less than high school OR: 3.81, 95% CI 1.25, 11.65), while being married was strongly associated with meeting PA guidelines in women (OR: 2.24, 95% CI 1.09, 4.62).

Discussion

In a large, community-based sample of South Asian adults, we found that higher perceived neighborhood social cohesion and features of the built environment were associated with higher PA levels in men and higher odds of meeting PA guidelines in men and women. These findings are consistent with prior studies that have found that social cohesion is positively associated with PA in other racial/ethnic groups, and also address gaps in knowledge about South Asian American health [16]. The difference in associations by sex - that neighborhood social and built environment factors were associated with activity behaviors in men, but only built environment factors were associated with activity behaviors in women - is novel. We surmise that perhaps neighborhood social cohesion plays a less salient role in activity behaviors among women than individual-level social relationships,

such as marital status and other personal ties. In unadjusted analyses, neighborhood social cohesion was associated with meeting PA guidelines among women (results not shown), but the effect was no longer significant once education level was adjusted for – corroborating this idea. It may also be that neighborhood social cohesion affects other behaviors among women, but not activity behaviors. This difference across sexes may be important to consider in the development of PA interventions targeting neighborhood factors.

Meaningful sociocultural influences within the South Asian American community have been recently synthesized, in particular in relation to PA and other lifestyle behaviors. In brief, PA is not necessarily viewed as a priority within South Asian culture and further, PA is viewed as something that should not produce stress on the body – a viewpoint that is in direct contrast to PA messaging in the U.S. [32]. A potential deterministic mechanism for healthy lifestyle behaviors may be through a retaining of native cultural norms but also through adopted values of the host culture [29] Participating in regular PA may also be viewed as conflicting with South Asian cultural norm of putting family before self – a factor that is of particular salience for South Asian women. Gender roles are also contributing factors in determining PA: for instance, qualitative studies suggest that South Asian women perform less exercise in part because of religious modesty, concerns about going out alone, and competing household priorities [32]. A recent analysis of personal social networks and health behaviors in the MASALA study cohort found that having network members who exercised only influenced women’s PA if the exercise partner was a spouse [33]. While a thorough examination of these factors is beyond the scope of the current manuscript, our gender-specific findings allude to these complex and unique underlying mechanisms in determining PA behavior in South Asian Americans.

The effect estimate observed for the odds of meeting PA guidelines with higher neighborhood cohesion was larger in magnitude compared to that reported in the prior work of Samuel et al., examining the same association in a multi-ethnic sample of U.S. adults (OR: 1.03, 95% CI 1.01, 1.05) [15]. While the cohort examined by Samuel et al. (the Multi-Ethnic Study of Atherosclerosis (MESA)) included Asian (Chinese) Americans in their sample, results disaggregated by racial/ethnic group were not presented [15]. In a recent analysis we conducted using data from the National Health Interview Survey (NHIS), we found that aggregated across racial/ethnic groups, neighborhood social cohesion was associated with higher odds of meeting PA guidelines (OR: 1.04, 95% CI 1.03, 1.05). However in interaction analyses, results appeared to be driven primarily by whites (OR: 1.30, 95% CI 1.20, 1.42) and Hispanics only (OR: 1.18, 95% CI 1.03, 1.34). No association was observed for African Americans or Chinese, Asian Indian or Filipino subgroups [16].

However in analyses disaggregated by racial/ethnic group, results are mixed. In national data, neighborhood social cohesion was associated with increased odds of meeting PA guidelines in Non-Hispanic white and Hispanic adults only – and not in Non-Hispanic black, Chinese, Asian Indian or Filipino American adults [16]. Similarly, in data from the California Health Interview Survey (CHIS), neighborhood social cohesion was shown to be associated with walking in whites and Hispanics but not in blacks and Asian Americans [34]. Other neighborhood factors including presence of sidewalks, park availability and nearby grocery stores have been previously shown to be associated with PA behaviors

in a mixed sample of Asian and Asian-Pacific Islander Americans [35], but beyond this manuscript, few studies have examined this association in Asian American populations.

A strength of the current analysis is the presentation of analyses focused on a specific subgroup of Asian Americans, with a substantial sample size of participants to support examination of the relationship between PA and neighborhood social cohesion. The utilization of validated and comprehensive tools for assessment of both the exposure and of the outcomes is an additional strength. We were also able to include neighborhood factors, such as length of time living in the neighborhood, perceived safety and walkability with Walk Score. The limitations of this analysis include that data were collected via self-report, which may be influenced by social desirability. Second, although our study uses a well validated neighborhood social cohesion scale in general U.S. populations, the psychometric properties of this scale have not been evaluated in South Asian populations. Lastly, results are not generalizable to all South Asian American immigrants, particularly given the stark bimodal income distribution observed across South Asian Americans [36].

Recent studies suggest that declines in cardiovascular disease mortality observed in the broader United States (U.S.) population in the past decade have not been as great in Asian American populations, indicating that current activities may not be reaching these groups [37, 38]. Given the rapid growth of the South Asian American population and higher cardiometabolic risks in this group, these findings suggest that strategies that target improved lifestyle behaviors such as PA in this community that target both the social and built neighborhood environments. Our findings also point towards a greater need to address the complex sociocultural mechanisms that underlie lifestyle behaviors in South Asian Americans. One potential avenue for this is through meaningful partnered translational research with South Asian American serving organizations and, for health research across multiple disciplines to move towards research that is more inclusive of Asian Americans as a whole [39].

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Table 1:

Selected covariates for study sample overall and stratified by neighborhood social cohesion, MASALA Study 2010–2013

	Overall n=903	Men n=484 n=903	Women n=419 n=903	p-value
Study site				
NWU (%)	45.3	48.8	40.8	0.02 ^b
UCSF (%)	54.8	51.2	59.2	
Demographics and health				
Age in years, mean ± SD	55.3 ± 9.4	56.1 ± 9.9	54.4 ± 8.6	<0.01 ^b
Education (%)				
Less than high school	6.7	4.6	9.3	<0.01 ^b
High school or equivalent	5.4	5.4	5.5	
College degree	28.8	25.4	32.9	
Graduate degree	59.1	64.7	52.3	
Annual Income (%)				
<\$40,000	13.1	12.9	13.3	0.57
\$40,000–<\$75,000	13.6	14.6	12.6	
\$75,000–<\$100,000	10.1	8.9	11.4	
\$100,000+	63.2	63.6	62.7	
Married (%)	90.7	95.7	85.0	<0.01 ^b
Neighborhood factors				
Neighborhood social cohesion, mean ± SD	18.5 ± 2.7	18.5 ± 2.6	18.5 ± 2.8	0.91
Time in neighborhood (years)	14.2 ± 8.9	13.9 ± 8.5	14.5 ± 9.4	0.29
Always feel safe in neighborhood	59.7	62.6	56.1	0.05
Park/playground within walking distance of home	95.6	95.3	95.9	0.61
Walk Score, mean ± SD	48.4 ± 22.5	49.1 ± 22.0	47.8 ± 23.0	0.40
Sociocultural factors				
Time in U.S. in years, mean ± SD	27.0 ± 10.8	27.5 ± 10.8	26.5 ± 10.8	0.19
Cultural traditions score, mean ± SD	14.0 ± 6.3	14.0 ± 6.2	14.1 ± 6.3	0.84
Social support, mean ± SD	24.9 ± 4.9	25.2 ± 4.9	24.6 ± 4.8	0.09
Activity behaviors				
Physical activity MET min/week, median (IQR) ^a	9442 (7350, 11970)	9221 (7346, 11490)	9720 (7410, 12795)	<0.01 ^b
Meets PA guidelines with exercise (%)	64.6	69.8	64.4	0.09

^aIncludes general activity, activity from occupation, and volunteer work

^bindicates statistical significance at p<0.05

Table 2:

Neighborhood factors and odds of log-transformed MET minutes/week of all physical activity by sex, MASALA Study 2010–2013

	Men				Women			
	β^2	95% CI		p-value	β^2	95% CI		p-value
Study Site								
NWU	1.00				1.00			
UCSF	1.03	0.97	1.11	0.34	1.08	0.99	1.18	0.07
Demographics and health								
Age, years	0.99	0.99	1.00	<0.01 ^a	0.99	0.98	0.99	<0.01 ^a
Education								
Less than high school (referent)	1.00				1.00			
High school or equivalent	0.65	0.52	0.81	<0.01 ^a	0.95	0.75	1.20	0.67
College degree	0.72	0.60	0.86	<0.01 ^a	1.03	0.88	1.21	0.68
Graduate degree	0.70	0.58	0.84	<0.01 ^a	1.11	0.95	1.30	0.20
Annual Income								
<\$40,000 (referent)	1.00				1.00			
\$40,000–<\$75,000	1.08	0.94	1.24	0.30	1.17	1.00	1.37	0.06
\$75,000–<\$100,000	1.16	0.99	1.36	0.06	1.05	0.88	1.24	0.60
\$100,000+	1.09	0.96	1.25	0.19	1.13	0.98	1.29	0.09
Married vs. Not Married	1.05	0.88	1.25	0.62	1.01	0.89	1.14	0.93
Neighborhood factors								
Neighborhood social cohesion, Tertiles								
Low (score: 8–17)	1.00				1.00			
Medium (score: 18–20)	1.02	0.95	1.11	0.57	0.98	0.89	1.08	0.68
High (score: 21–25)	1.17	1.06	1.29	<0.01 ^a	1.01	0.90	1.13	0.90
Time in neighborhood, years	1.00	0.99	1.00	0.90	1.01	1.00	1.01	0.01 ^a
Always vs. do not always feel safe in neighborhood	1.01	0.94	1.09	0.77	1.05	0.97	1.14	0.25
Park/playground within walking distance of home	1.22	1.04	1.43	0.02 ^a	1.17	0.95	1.45	0.15
Walk Score, one-unit change	1.00	1.00	1.00	0.04	1.00	1.00	1.00	0.96
Acculturation-related factors								
Time in U.S., years	1.00	0.99	1.00	0.06	1.00	0.99	1.00	0.94
Cultural traditions score, one-unit change	1.00	0.99	1.01	0.98	0.99	0.99	1.00	0.09
Social support	1.00	1.00	1.01	0.27	0.99	0.99	1.00	0.20

^a indicates statistical significance at p<0.05

Table 3:

Neighborhood factors and odds of meeting physical activity guidelines by sex, MASALA Study 2010–2013

	Men			p-value	Women			
	β^2	95% CI			β^2	95% CI		p-value
Study site								
NWU	1.00				1.00			
UCSF	1.33	0.84	2.09	0.22	0.89	0.55	1.44	0.63
Demographics and health								
Age, years	1.01	0.98	1.04	0.40	1.01	0.98	1.04	0.56
Education								
Less than high school (referent)	1.00				1.00			
High school or equivalent	0.62	0.16	2.41	0.49	0.91	0.26	3.12	0.88
College degree	2.99	1.00	8.99	0.05	1.87	0.81	4.31	0.14
Graduate degree	3.81	1.25	11.65	0.02 ^a	2.04	0.89	4.65	0.09
Annual Income								
<\$40,000 (referent)	1.00				1.00			
\$40,000–<\$75,000	1.06	0.45	2.50	0.89	1.14	0.49	2.64	0.77
\$75,000–<\$100,000	0.91	0.34	2.44	0.86	1.92	0.76	4.84	0.17
\$100,000+	1.14	0.50	2.62	0.75	1.88	0.89	3.96	0.10
Married vs. Not Married	0.81	0.28	2.40	0.71	2.24	1.09	4.62	0.03 ^a
Neighborhood factors								
Neighborhood social cohesion, Tertiles								
Low (Score: 8–17)	1.00				1.00			
Medium (Score: 18–20)	1.93	1.18	3.17	0.01 ^a	1.24	0.75	2.05	0.40
High (Score: 21–25)	1.98	1.01	3.89	0.05	1.91	0.99	3.69	0.05
Time in neighborhood, years	1.01	0.98	1.04	0.55	0.99	0.97	1.02	0.73
Always vs. do not always feel safe in neighborhood	1.04	0.65	1.67	0.88	1.14	0.71	1.81	0.59
Park/playground within walking distance of home	3.14	1.20	8.24	0.02 ^a	3.67	1.17	11.52	0.03 ^a
Walk Score, one-unit change	1.00	0.99	1.01	0.97	1.00	0.99	1.01	0.70
Acculturation-related factors								
Time in U.S., years	0.99	0.97	1.02	0.64	1.02	0.99	1.05	0.18
Cultural traditions score, one-unit change	1.03	0.99	1.07	0.19	1.01	0.98	1.05	0.48
Social support	1.04	1.00	1.09	0.07	1.00	0.95	1.04	0.91

^a indicates statistical significance at p<0.05