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Article

The power of social networks and social support in promotion of physical activity and body mass index among African American adults

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ABSTRACT

Social support and social networks can elucidate important structural and functional aspects of social relationships that are associated with health-promoting behaviors, including Physical Activity (PA) and weight. A growing number of studies have investigated the relationship between social support, social networks, PA and obesity specifically among African Americans; however, the evidence is mixed and many studies focus exclusively on African American women. Most studies have also focused on either functional or structural aspects of social relationships (but not both) and few have objectively measured moderate-to-vigorous physical activity (MVPA) and body mass index (BMI). Cross-sectional surveys of adult African American men and women living in two low-income predominantly African American neighborhoods in Pittsburgh, PA (N = 799) measured numerous structural features as well as functional aspects of social relationships. Specifically, structural features included social isolation, and social network size and diversity. Functional aspects included perceptions of social support for physical activity from the social network in general as well as from family and friends specifically. Height, weight, and PA were objectively measured. From these, we derived Body Mass Index (BMI) and moderate-to-vigorous physical activity (MVPA). All regression models were stratified by gender, and included age, income, education, employment, marital status, physical limitations, and a neighborhood indicator. Greater social isolation was a significant predictor of lower BMI among men only. Among women only, social isolation was significantly associated with increased MVPA whereas, network diversity was significantly associated with reduced MVPA. Future research would benefit from in-depth qualitative investigations to understand how social networks may act to influence different types of physical activity among African Americans, as well as understand how they can be possible levers for health promotion and prevention.

Introduction

African American adults are disproportionately affected by obesity compared with non-Hispanic White adults. Specifically, 48.4 percent of African Americans suffer from obesity (including 38 percent of men and 57.2 percent of women) compared with 36.4 percent of Whites (including 34.7 percent of men and 38.2 percent of women) (Flegal, Kruszon-Moran, Carroll, Fryar & Ogden, 2016). Robust evidence suggests that engaging in regular physical activity (PA) is crucial to maintaining energy balance required for staying at a healthy weight, yet less than half of African American adults (42.4%) meet the federal

PA guidelines compared to 52.9% for White adults (Ward, Clarke, Nugent & Schiller, 2016). An even smaller percentage of African American women (13.6%) achieve recommended PA levels, representing one of the lowest prevalence for any race and sex demographic group (U.S. Department of Health and Human Services, 2017). This difference constitutes an important racial disparity that warrants further research because a proportion of the observed difference may result from unfair, unjust, or inequitable access to resources for certain racial/ ethnic minorities in the U.S. (Institute of Medicine, 2003).

Indeed, disparities related to physical activity have been attributed to a myriad of obstacles faced by African Americans, including greater

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barriers to places where people can be physically active (Cutts, Darby, Boone & Brewis, 2009; Eugeni, Baxter, Mama & Lee, 2011). These inequities seem to be particularly acute for African American women (Black Women's Health Imperative, 2017).

Other research has suggested that factors such as social support may be associated with higher levels of engagement in PA among African Americans (Siceloff, Coulon & Wilson, 2014). Indeed, a growing number of studies have investigated the relationship between social support and PA among African Americans; still, the evidence on the role of gender is mixed, in part, since many studies exclude men and most studies rely on global measures of support rather than PA-specific support (Ainsworth, Wicox, Thompson, Richter & Henderson, 2003; Coulon, Wilson & Egan, 2013; Eyler et al., 1999; Harley et al., 2009; Hooker, Wilson, Griffin & Ainsworth, 2005; Johnson, Carson, Affuso, Hardy & Baskin, 2014; Kanu, Baker & Brownson, 2008; Komar-Samardzija, Braun, Keithley & Quinn, 2012; Li et al., 2012; Sharma, Sargent & Stacy, 2005; Siceloff et al., 2014). This is despite the evidence that having a companion for physical activity is among the most important social support determinants for physical activity (Wendel-Vos, Droomers, Kremers, Brug & van Lenthe, 2007) and that African Americans appear to have a variety of sources of social support for physical activity, including family, friends, neighbors, and members in religious congregations (Ainsworth et al., 2003; Harley et al., 2009; Kanu et al., 2008; Wilbur, Chandler, Dancy & Lee, 2003).

A related set of research has focused more exclusively on the role of social networks, which focuses on the structural aspects of social relationships (Holt-Lunstad, Robles & Sbarra, 2017). Theoretically distinct from the construct of social support, social networks refer to the “web of social relations around an individual,” and typically include one's individual contacts and the nature of the ties that connect the individuals (Berkman and Glass, 2000; Smith and Christakis, 2008). These studies have elucidated some important features of social networks in relation to physical activity and weight-related outcomes. For example, the risk of becoming obese has been associated with the size and density of one's social network (Christakis and Fowler, 2007). In terms of physical activity, having a spouse and/or supportive family and friends are positively associated with increased physical activity (Eyler et al., 1999; Sternfeld, Ainsworth & Quesenberry, 1999) as well as other structural features such as social network size (Emmons, Barbeau, Gutheil, Stryker & Stoddard, 2007; Shelton et al., 2011; Tamers et al., 2013; Yu et al., 2011) and social isolation, or the absence of contact with other individuals or a deficiency in social relationships or integration (Herbolsheimer, Mosler, Peter & Acti, 2016; Robins et al., 2017; Robins, Hill, Finch, Clemson & Haines, 2016). Differences in composition of personal networks for men and women are also noteworthy as social networks have shown to have different functions across gender (McNeill, Kreuter & Subramanian, 2006; Pugliesi and Shook, 1998). For instance, there is evidence that women find prioritizing weight loss and exercise difficult given their roles as caregivers and other household and family responsibilities (Daniels, 2006) and other studies find that certain family members could undermine women's intention to engage in physical activity (Mackert, Stanforth & Garcia, 2011).

The current study was motivated by the gap in knowledge regarding the social relationships that might motivate or prevent African American adults in engaging in physical activity. We were particularly interested in understanding the extent to which structural features such as social network size, diversity and social isolation differentially predict physical activity and body weight from functional features such as social support, since there is evidence to suggest these influence health through different pathways (Cohen and Janicki-Deverts, 2009). Our study was also designed to address previous methodological limitations in the literature, including a measure of PA-specific support rather than a global measure of support since prior research has highlighted PA-specific support, such as having a companion for physical activity, as an important determinant of various forms of physical activity (Wendel-

Vos et al., 2007). We also use objectively measured outcomes of physical activity and body weight rather than reliance on self-report. Taken together, this study contributes to our current understanding of the role of social relationships in a population that is disproportionately affected by obesity and physical inactivity.

Methods

Population and data

The Hill District and Homewood neighborhoods are two low-income, predominantly African American neighborhoods in Pittsburgh, PA. Although they are sociodemographically similar, the Hill District has been experiencing notable changes as a result of multiple large economic investments, highlighted by the opening of a full-service supermarket which opened in 2013, housing improvements, and associated landscaping/aesthetic improvements. In turn, multiple studies (see funding acknowledgment section) have capitalized on the opportunity to collecting information from a randomly selected cohort which began with 1372 residents in both neighborhoods in 2011. Our sampling approach, recruitment, and eligibility for our first research effort and baseline data have been described in detail elsewhere (Dubowitz, Ghosh-Dastidar et al., 2015; Dubowitz, Ncube, Leuschner & Tharp-Gilliam, 2015). To look at greenspace improvements, the Pittsburgh Research on Neighborhoods, Exercise and Health (also known as “PHRESH Plus”) study was created to follow the same cohort and rigorously measure physical activity. This paper reports on the PHRESH Plus baseline data which was collected in the Spring 2013 (n = 1051), prior to major greenspace and housing renovations.

In addition to an extensive survey that tapped into socio-demographics, psychosocial factors, social networks and social isolation, biometric data was collected. Trained data collectors measured participant's height and weight. Specifically, height was measured to the nearest eighth inch using a carpenter's square (triangle) and an 8-ft folding wooden ruler marked in inches. Body weight was measured using the SECA Robusta 813 digital scale. Interviewers recorded weight as it appeared on the scale's LCD display, to the nearest tenth of a pound. Lastly, participants were given an Actigraph GT3X+ accelerometer along with instructions for how to wear the device, such as placing it on their non-dominant wrist for 7 consecutive (24 hour) days. Though this biometric data has been collected at multiple time points, the social network questions were asked at one time point so that the design of this study is cross-sectional. All study protocols were approved by the RAND Human Subjects Protection Committee.

Measures of structural features of social relationships

Social network size

To assess the size of participants' social networks, we used a validated questionnaire to construct a network size index (Vardavas and Marcum, 2012). Specifically, participants were asked to think of all the people they know, who know them, and with whom they have had regular contact within the past six months. The contact could be face-to-face, by phone or mail, or on the Internet. Based on these criteria for defining members of their social network, participants were asked to enumerate the number of social network members in each of these categories: (1) family members (immediate family, birth family, spouse, in-laws) (2) close friends (3) co-workers (4) neighbors (5) people in their religious community or attend the same place of worship (e.g., church) (6) others (e.g., people they know through recreational activities, etc.). The number of people in each category was summed to compute each participant's social network size. Finally, we used frequencies to trim implausible values.

Social Isolation

Prior work defines social isolation as the absence of contact with

other individuals or a deficiency in social relationships or integration (Coyle and Dugan, 2012). However, because the study did not have a measure of self-reported perceptions of social isolation, we constructed this variable based on the bottom 20% of their social network size. Similar approaches have been used in prior research on social isolation and health outcomes (Flowers et al., 2017; Pantell et al., 2013; Pohl, Cochrane, Schepp & Woods, 2017). Based on this empirical definition, people with ≤ 13 in their social network (i.e., bottom 20%) were categorized as socially isolated and those with > 13 in their social network were not considered socially isolated.

Social network diversity

To measure the extent to which participants' social networks were comprised of diverse role categories of network members (i.e., diverse mix of family, friends, coworkers etc.) we used the formula in Blau's index of diversity (Blau, 1977) recently applied to diverse, ethnic, urban populations (Negrón, 2014). Specifically, the index is calculated by $1 - \sum p_i^2$, where p is the proportion of network members in a given category and i is the number of different categories of network member roles ($i = 6$). Higher levels of diversity of network member roles result in scores approaching 1, whereas scores approaching 0 denote low levels of diversity in roles. However, when $i = 6$, the maximum possible value of this measure is 0.833.

Measures of functional aspects of social relationships

Social support for physical activity

Specific to PA, participants were asked two questions regarding the extent to which people in their social network were supportive of physical activity; as well as whether there were individuals who participated in physical activity with them (e.g., going out for a walk with them in the past week). For PA-related support, we created three separate exposure variables to capture social network members who support PA, who participated in PA with participant, and the family and friends who support PA. First, we summed the number of participants' network members who were likely to support them to be physical active. Second, we calculated the percent of the participants' network who actually participated in physical activity in the past week (i.e., gone for a walk) with the participant. Third, the family and friend support scale was derived from a set of three items that asked the participant whether a family or friend had done the following in the past 3 months. Specifically, the times asked whether the person (1) Engaged in physical activity with you; (2) Offered to do physical activity with you; (3) Given encouragement to do physical activity. Participants were asked to rate each item using a 5-point Likert scale of "never, rarely, sometimes, often, and very often." The scale of perceived family or friend support had good internal consistency as measured by a Cronbach's alpha coefficient of 0.82. The correlation between actual receipt of support and perceiving support from family or friends was 0.13, $p = 0.0004$.

Outcomes

Body Mass Index (BMI)

Data collectors measured height and weight, and BMI was derived from the standard formula of weight (kg) divided by height squared (m^2). Data collectors were trained in anthropometric procedures and measured height using a carpenter's square (triangle) and an 8-ft folding wooden ruler marked in inches. Height was recorded to the nearest one-eighth of an inch. Interviewers entered adjustments to the height—e.g., for shoes or hair ornaments that the respondent chose not to remove. Respondent weight was measured using the SECA Robusta 813 digital scale, which was capable of weighing respondents up to 400 pounds. If the respondent weighed more than 400 pounds, self-reported weight was used ($n = 2$). Interviewers recorded weight as it appeared on the scale's LCD display, to the nearest one-tenth of a pound.

Moderate to vigorous PA (MVPA)

Participants wore a tri-axial accelerometer (i.e., Actigraph GT3X+) on their non-dominant wrist for 7 consecutive (24 hour) days. Data were sampled at 30 hz and stored in gravity (g) units ($1 g = 9.81 m/s^2$). Data were processed in R using the GGIR package 1.2–8 (<http://cran.r-project.org>). Using static periods in the data, calibration error was estimated and corrected if necessary (van Hees et al., 2014). As has been done in other studies (Sabia et al., 2014), non-wear time was identified when the standard deviation (SD) was less than 13 mg for 2 of the 3 axes and if the value range of each accelerometer axis was less than 150 mg, calculated for moving windows of 60 min with 15-min increments (van Hees et al., 2013). Acceleration was quantified using the vector magnitude from the three axes minus the value of gravity (g) (i.e., $(x^2 + y^2 + z^2)^{1/2} - 1$) referred to as ENMO (Euclidean norm minus one). Negative numbers were rounded to zero. **Moderate to vigorous intensity PA (MVPA)** was defined as a bout of at least 10 min of activity where at least 80% of the bout was above the threshold of 100 mg (Hildebrand, VT, Hansen & Ekelund, 2014). The average daily minutes of moderate to vigorous activity was calculated for those with valid wear time, defined as having at least 10 h of wear on at least 4 out of 7 days.

Analytic sample

The final analytic sample was 799. Of the full sample of 1,051, we excluded respondents who lived outside either one of the two study neighborhoods at wave 2 ($n = 37$), were missing MVPA data ($n = 160$), had too few (< 4) valid accelerometer wear days to calculate MVPA ($n = 30$), were missing report of limited physical functioning (i.e., could not walk one block) ($n = 1$), were missing social network diversity ($n = 11$), were missing the percent of social network who support PA ($n = 8$), or were missing the percent of the social network who have gone for a walk with the participant ($n = 5$). We calculated t-tests (continuous variables) and chi-Square tests (categorical variables) to compare baseline characteristics of respondents that are included ($N = 799$) versus excluded ($n = 252$) from analysis. The excluded participants were younger ($p = 0.02$), had less social diversity ($p < 0.01$), and spent more time in MVPA ($p < 0.01$).

Analyses

Preliminary analyses assessed outcome distributions and applied transformations as necessary. To ensure normality, we applied a log transformation to BMI because its distribution was skewed (Shapiro-Wilk $p < 0.001$). We then conducted testing, using t-tests for continuous variables and chi-square tests for categorical variables to examine differences in social network characteristics, outcomes, and covariates for men and women. Our primary analytic approach involved regression modeling. We used a linear regression model for log-transformed BMI and a zero-inflated negative binomial model for MVPA, estimated using the software package Stata 14 (StataCorp, 2015). Vuong tests supported the need to use zero-inflated regression for the MVPA outcome models versus standard negative binomial models (Cheung, 2002). Further, PA-specific social support predictors are only used in MVPA models. We report back-transformed Betas or regression coefficients from linear models, and incidence rate ratios from the zero-inflated negative binomial models.

Prior research indicates that associations between social network characteristics and outcomes may differ by gender. Therefore, in preliminary analysis, we tested for significant interactions among key predictors and gender in the regression models. These tests of interaction terms provided justification to conduct stratified analyses by gender. Stratified models controlled for the following covariates: age (measured as a continuous variable in years), income (continuous and adjusted for household size), education (binary; some college/bachelors vs. less than college), marital status (binary; married/living with

Table 1
Characteristic of the Study Sample, by Gender.

	Total sample N = 799 % or Mean (SD)	Men n = 183 % or Mean (SD)	Women n = 616 % or Mean (SD)
Age, years	55.9 (16.2)	57.5 (14.8)	55.4 (16.5)
Annual adjusted household income, (per \$1000)	13.3 (13.0)	15.8 (13.5)	12.6 (12.8)**
Education			
Some college/bachelors	45.2	46.5	44.8
Less than college	54.8	53.5	55.2
Employment			
Full-time/part-time	37.9	37.2	38.2
Not employed	62.1	62.8	61.8
Marital status			
Married/living with partner	21.5	20.8	21.8
Single/widowed/divorced/separated	78.5	79.2	78.2
Physical limitation	28.0	27.3	28.3
Neighborhood			
Hill District	68.5	65.6	69.3
Homewood	31.5	34.4	30.7
Social Networks/Social Support			
Socially isolation	19.9	20.9	19.6
Diversity	0.6 (0.2) [range 0–0.8]]	0.6 (0.2) [range 0–0.8]	0.6 (0.2) [range 0–0.8]*
Social network size	45.7 (48.6)	46.7 (54.2)	45.4 (46.9)
% of social network supportive PA	40.4	44.0	39.4
Number of family/friends supportive PA	20.9 (7.1)	20.2 (7.0)	21.0 (7.1)
% of social network supportive for walk in the past week	4.6	4.9	4.6
Body Mass Index	31.2 (7.7)	28.9 (6.6)	32.0 (7.8)***
Daily Physical Activity			
Moderate-to-vigorous physical activity, minutes	6.2 (18.9)	12.2 (25.4)	4.5 (16.1)***
% achieving 150 min moderate-to-vigorous physical activity per week	7.6 (0.3)	15.3 (0.4)	5.4 (0.2)***

†p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001

partner vs. single/widowed/divorced/separated), self-reported physical limitation with walking one block (dichotomous), employment (dichotomous, full-time/part-time vs. not employed), and neighborhood indicator (Homewood vs. Hill District) to account for unmeasured differences across neighborhoods. Lastly, we controlled for MVPA in the BMI models and BMI in the MVPA models because adults with higher BMIs are less likely to engage in physical activity and vice versa (Kruger, Yore & Kohl, 2008).

Results

Table 1 shows sociodemographic characteristics for the analytic sample (N = 799) overall and by gender. In the full sample, participants had a mean age of 56 and annual income of \$13,300. Over half (54.8%) had less than a college education, with 62.1% not employed and 78.5% single/widowed/divorced/separated. More than a quarter of the sample reported having physical limitations to walk one city block (28%), and over 60 percent resided in the Hill District (68.5%). The only sociodemographic characteristic that differed between men and women was annual income, with women reporting a lower annual household income than men (\$12,600 vs. \$15,800, respectively).

Table 1 also shows the distribution of social network characteristics and social support. The sample reported having a diverse network composition according to the mean score of the Blau’s diversity index

Table 2
Linear regression model of social network characteristics predicting log-transformed BMI, stratified by gender.

	Men		Women	
	Unadjusted 100*(e ^β -1) (SE)	Adjusted‡ 100*(e ^β -1) (SE)	Unadjusted 100*(e ^β -1) (SE)	Adjusted‡ 100*(e ^β -1) (SE)
Social isolation	-9.2* (0.04)	-8.1* (0.04)	-1.2 (0.02)	-1.4 (0.02)
Diversity	5.0 (0.11)	-0.17 (0.11)	2.3 (0.07)	1.3 (0.07)
Social network size	0.04 (< 0.01)	0.03 (< 0.01)	0.03 (< 0.01)	0.03 (< 0.01)

‡Separate models for each of the social network characteristics adjusted for age, income, education, employment, marital status, physical limitations, neighborhood, and MVPA

†p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001.

(Mean 0.6, SD = 0.2, range 0–0.8). Average network size among all participants was about 46 people; 40 percent perceived support for PA from their entire network, while only 20 percent perceived family and friends to be supportive for PA. Only about 5% had actual received instrumental support in the form of a walk in the past week. When comparing these scores between men and women, only network diversity was significantly different, with women having slightly more diverse networks compared to men. Table 1 also shows the distribution of BMI and physical activity outcomes. Mean BMI was over 30 for the entire sample, with women having significantly higher BMI compared to men (32.0 vs. 28.9). Women also engaged in less moderate-to-vigorous physical activity than men (4.5 minutes vs. 12.2).

Table 2 presents unadjusted and adjusted associations between structural measures (i.e., social isolation, social network size and diversity) and log-transformed BMI by gender. Only social isolation approached statistical significance in association with BMI among men in both unadjusted and adjusted (p < 0.05) models and there were no significant findings for women. Specifically, net of differences in covariates, a 1-unit increase in social isolation was associated with an 8.1% decrease (which is 100*(e^β - 1), where β = -0.08, p = .03) in BMI among men.

Table 3 presents incidence rate ratio associations from the negative binomial model between the same structural measures (i.e., social isolation, social network size and diversity) as well as functional measures tapping PA-specific social support and MVPA by gender. Of the structural measures, social isolation and diversity were significantly associated with MVPA in the adjusted models for women, but not for men. Specifically, 1-unit increase in social isolation would increase MVPA by a factor of 2.0 (β = 0.71, p < = 0.002), which translates into 9 additional minutes of daily MVPA (average MVPA for women is 4.5 minutes a day). Further, a 1-point increase in diversity was associated with a decrease in MVPA y a factor of 0.1 (β = -2.02, p < 0.001), which translates to about 0.5 fewer minutes of MVPA per day.

Discussion

By focusing on structural and functional aspects of social relationships separately, this study was able to show a differential impact of these two important domains of the social environment. Specifically, our findings showed that social isolation was associated with lower BMI among men and increased MVPA among women. That is, men who were socially isolated had lower BMI than non-isolated men. In contrast, for women, being socially isolated was associated with more MVPA, potentially because their social network discourages health behaviors like MVPA as other studies among women have found (Mackert et al., 2011). Diversity of social network, however, was significantly associated with less MVPA among women. Upon first glance,

Table 3
Zero-Inflated Negative Binomial Model of Social Support and Social Network Characteristics Predicting Moderate-to-Vigorous Intensity (MVPA), Stratified by Gender.

MVPA	Men		Women	
	Unadjusted IRR (SE)	Adjusted‡ IRR (SE)	Unadjusted IRR (SE)	Adjusted‡ IRR (SE)
% of social network supportive PA	1.00 (< 0.01)	1.00 (< 0.01)	1.00 (< 0.01)	1.00 (< 0.01)
Family/friend supportive PA score	1.02 (0.02)	1.01 (0.02)	0.98 (0.01)	0.98 (0.01)
% of social network supportive for walk in the past week	0.98 (0.02)	0.99 (0.02)	1.00 (0.01)	1.02 (0.01)
Social isolation	0.77 (0.27)	0.62 (0.20)	2.01** (0.44)	2.03** (0.47)
Diversity	5.6 (5.20)	5.2 (4.94)	0.19*** (0.08)	0.13*** (0.07)
Social network size	1.00 (< 0.01)	1.00 (< 0.01)	1.00 (< 0.01)	1.00 (< 0.01)

‡ Separate zero-inflated negative binomial models for each of the social network characteristics adjusted for age, income, education, employment, marital status, physical limitations, neighborhood, and BMI. The inflate statement included “age” and estimates are not presented but were statistically significant at $p < 0.001$
† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

these findings seem contradictory to the literature on social support and physical activity among African Americans. For example, several studies have found social support is associated with several different domains of physical activity, including moderate-to-leisure time physical activity (Coulon et al., 2013; Sharma et al., 2005; Siceloff et al., 2014). None of these studies, however, measured the extent of support for physical activity from different network members. The strength of our measure is that it included all members in a person’s social network, such as proximal groups like friends and families, as well as more distal members like neighbors and coworkers. Further, it is consistent with a prior study of African American women in the Deep South (Johnson et al., 2014), which found family and friends were a major source of discouragement for engaging in health behaviors. Diversity of network might not help in this regard either if negative norms around physical activity for African American women are held by proximal and distal groups alike. Future research should measure the extent to which network members know one another since our study was unable to do so, and test the extent to which network density promotes or discourages health behaviors, including physical activity (Valente, 2010).

Our finding on social isolation also highlights some important factors that may be important for our understanding the provision of social support for physical activity among African Americans and how the mechanisms might differ across gender. For example, African American women who are socially isolated may have few interactions with physically inactive network members, and may rarely participate in social activities that promote sedentary behaviors (Cornwell and Waite, 2009). On the other hand, socially isolated men might have healthier eating behaviors given other research that suggests those who are socially integrated may eat out and drink more (Hawkey, Bureson, Bertson & Cacioppo, 2003; Tomaka, Thompson & Palacios, 2006). Qualitative data among African Americans suggests there is a great pressure to conform to family preferences regarding factors associated with BMI such as food preferences (Bertoni et al., 2011; James, 2004) and future research should explore how men and women use food and physical activity to cope with these pressures of the social network they are embedded in as well as with social isolation.

Despite the insights provided by this study, several limitations should be noted. First, this cohort had very low levels of MVPA which limited variation in our sample and reduced statistical power. Specifically, lack of variation in MVPA may have reduced our ability to detect statistical significance and results for men should be interpreted with caution since those analyses had lower statistical power due to the smaller sample size of men. Relatedly, including a measure of light-intensity physical activity might be an important domain to explore above-and-beyond MVPA in future research. Second, the measure of social isolation in this study was an empirically-derived measure, based on the lower 20% of the social network size distribution. We recognize that this is a study-specific definition that may not apply to other

populations, and may not correlate with the subjective experience of being socially isolated.

Third, environmental factors and individual factors simultaneously shape physical activity. We acknowledge that beyond the interpersonal domain we have focused on (i.e., social support, social networks) social environments are comprised of other equally important domains such as inequitable access to parks, as well as neighborhood and community characteristics (e.g., social capital) (McNeill, Wyrwich, Brownson, Clark & Kreuter, 2006b). We did however, attempt to control for variation between the neighborhoods in order to focus on the predictive value of social support and social networks above-and-beyond these factors. Fourth, because the social network data was only collected once, the cross-sectional nature of the study precluded us from examining how these social network characteristics are associated with BMI and PA over time. Longitudinal studies are needed and should explore not only the extent to which social network characteristics lead to changes in MVPA and PA over time, but also how changes in the neighborhood environment may lead to fundamental changes in social network characteristics including social support. Lastly, frequency and duration of exposure to stressors are important factors when attempting to understand how social networks influence health. Though our dataset was limited in this regard, we controlled for some stressors that would fundamentally hamper physical activity (e.g., physical limitation). Nonetheless, future studies should employ in-depth qualitative methodology to unpack how features of social networks (e.g., social isolation) may be associated with BMI and physical activity.

According to the goals set forth by Healthy People (2020), African Americans are still disproportionately affected by lower levels of physical inactivity and higher levels of obesity (Healthy People, 2020). Our work highlights the importance of understanding social networks and social support in order to engage this community regarding physical activity, though there is still much work to be done in order to understand how exactly the resources and norms that arise from social networks can be shaped for health promotion and disease prevention in vulnerable populations.

Ethics approval

All studies (PIs Dubowitz/Troxel) were approved by the RAND Human Subjects Protection Committee.

Conflict of interest statement

The authors whose names are listed immediately above certify that they have NO affiliations with or involvement in any organization or entity with any financial interest.

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