Original Report:
Obesity

Neighborhood Social Predictors of Weight-related Measures in Underserved African Americans in the PATH Trial

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African Americans have the highest rate of obesity in the United States relative to other ethnic minority groups. Bioecological factors including neighborhood social and physical environmental variables may be important predictors of weight-related measures specifically body mass index (BMI) in African American adults. Baseline data from the Positive Action for Today's Health (PATH) trial were collected from 417 African American adults. Overall a multiple regression model for BMI was significant, showing positive associations with average daily moderate-to-vigorous physical activity (MVPA) (B =-.21, $P<.01$) and neighborhood social interaction (B =-.13, $P<.01$). Consistent with previous literature, results show that neighborhood social interaction was associated with healthier BMI, highlighting it as a potential critical factor for future interventions in underserved, African American communities. *Ethn Dis*. 2015; 25(4):405-412; doi:10.18865/ed.25.4.405

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Introduction

Obesity prevention has become a national priority given the increasingly high prevalence of this condition among US adults.[1] Currently, 68.5% of American adults (≥20 years old) are overweight and almost 35% are obese[2]; these conditions are associated with increased risk of cardiovascular disease, cancer, and type 2 diabetes.[3] Additionally, 76.2% of African American adults are classified as overweight and 47.8% as obese,[2] demonstrating a substantial health disparity for this population. The etiology of obesity and related health disparities is complex[4] and driven largely by environmental and social factors; however, research that specifically investigates the role of the neighborhood social environment in at-risk African Americans has been limited. It is therefore important to investigate the influence of the neighborhood environment on weight-related measures to better understand determinants of obesity in this at-risk population.

Using a bioecological theoretical framework, our study examined neighborhood social and physical environmental factors that potentially influence weight outcomes. Bioecological frameworks postulate that behavior is influenced by factors in one's immediate environment (eg, family, friends), and also by those in broader, more distal contexts (eg, neighborhood).[5] While many investigators have shown strong associations of social environmental factors such as social support, and role-modeling, on understanding physical activity (PA),[6-8] there has been little research on social environmental factors of weight-related measures, particularly in African American adults. Even less research has examined links among weight-related measures and neighborhood factors such as social interactions, perceived satisfaction, and perceived safety.

While there currently is limited research on weight-related measures particularly in underserved populations, researchers have been increasingly interested in how the social environmental factors and the neighborhood built environment are associated with the prevalence of obesity and weight-related measures. Cohen and colleagues[9] found that neighborhood collective efficacy mediated the relationship between concentrated disadvantage and all-cause prema-

ture mortality. Additionally, Wanko and colleagues[10] found that individuals with higher BMI were more likely to report having personal and health-related barriers for exercising. Furthermore, individuals with lower socioeconomic status (SES) have reported having fewer opportunities to be physically active, due to concerns about safety,[11,12] or because of not having access to workout facilities.[13] Fish et al[14] found that individuals who rated their neighborhoods as unsafe had a 2.81 times higher BMI than those who perceived their neighborhoods as more safe. Finally, Siceloff, Coulon and Wilson[15] found that moderate-to-vigorous physical activity (MVPA) mediated the relationship between infrastructure for walking (places for walking and cycling within their neighborhood) and BMI outcomes in an underserved African Americans. Taken together, these studies provide preliminary support for the importance of understanding the relationship between neighborhood social and built environmental factors on obesity and weight-related measures in underserved African Americans.

The purpose of our study was to further examine whether factors based on a bioecological framework contribute to predicting weight-related measures in underserved, African American adults in the Positive Action for Today's Health (PATH) trial.[16,17]

Thus, the purpose of our study was to further examine whether factors based on a bioecological framework contribute to predicting weight-related measures in underserved, African American adults in the Positive Action for Today's Health (PATH) trial.[16,17] Specifically, our study expands on past literature by evaluating the associations of neighborhood factors (places to walk and bike, neighborhood satisfaction, perception of safety, and neighborhood social interaction) and peer support on body mass index (BMI) in African American adults. Based on previous research, it was hypothesized that neighborhood social and environmental factors would be significantly predictive of BMI in our study.

Method

Study Design and Procedures

The PATH randomized trial has been previously described in detail elsewhere.[16,17] Data for our study were assessed at baseline and included height, weight, blood pressure and physical activity. Additionally, psychosocial and demographic data (age, sex, education status, annual income, occupational status, and marital status) were obtained by trained research staff. The study was approved by the institutional review board at the University of South Carolina, and all participants signed an informed consent prior to participating.

Participants

Data were collected from 417 African American adults who resided in one of three low-income communities that took part in the PATH randomized trial, which tested the efficacy of a walking program on PA.[16] The three communities were matched on poverty rates, crime rates, and PA levels. Inclusion criteria included being: 1) African American (three of four grandparents of African American heritage); 2) aged >18 years; 3) having no plans to move during the 2-year study period; 4) having no medical condition limiting participation in moderate intensity exercise; 5) residing in one of three census-specified communities; and 6) having controlled blood pressure (systolic < 180 mm Hg and diastolic < 110 mm Hg) and blood sugar levels (nonfasting < 300 mg/dL and fasting ≤ 250 mg/dL). Finally, if participants answered "yes" to any item of the Physical Activity and Readiness Questionnaire,[18] they were excluded.

Psychosocial Measures

Neighborhood Environment Walkability Survey (NEWS)

Three subscales from the NEWS[19] were utilized. The Places for Walking and Cycling subscale measured infrastructure for walking and access to services based on evidence that neighborhood

features are associated with walkability (eg, sidewalks, trails). This subscale showed acceptable alpha reliability (α=.79). The Neighborhood Satisfaction subscale assessed participants' satisfaction with their neighborhood. This subscale showed acceptable alpha reliability (α=.71). Thirdly, the Perception of Safety subscale assessed participants' perceptions about neighborhood safety. The alpha reliability for this scale was (α=.69) in this study.

Neighborhood Social Interaction and Peer Support

The Neighborhood Social Interaction survey asked participants how many days they participated in a certain activity in the past month in their neighborhood,[20] including, "wave to a neighbor," and "sought advice from a neighbor." This survey had an acceptable alpha reliability (α=.80) in this study. Peer social support for PA was assessed by using the Social Support for Exercise Behavior Questionnaire,[21] which assessed perceived social support for PA from peers in the past three months. This scale showed high internal consistency (α=.89) in this study.

Demographics

Demographic data were collected at baseline, and included self-reported age, sex, education level attained, and annual household income. Furthermore, blood pressure was assessed by a trained staff member.

Anthropometrics

BMI was collected by trained staff. BMI was calculated with height measured with a Shorr-Board and weight measured with a Seca 880 scale. Three measures of height and weight were averaged and the BMI was estimated using the standard formula of weight (kg) / height $(m)^2$.

Physical Activity Measurement (Accelerometers)

Assessments of MVPA behavior were obtained using seven consecutive days of Actical accelerometers (Mini-Mitter, Bend, Ore.) wear. Research shows that Acticals yield consistent values as compared with other empirically tested accelerometers (eg, MTI Actigraph, Caltrac, Tritrac).[22] Acticals have test-retest reliability coefficients for MVPA ranging .85-.90.[23] MVPA was included as a covariate in the model because it has been shown to correlate with BMI.

Data Analytic Plan

Linear regression analysis was conducted using a hierarchical approach to evaluate the best predictors for BMI. Covariates included age, sex, MVPA and community. Age, sex, and MVPA were chosen as covariates given their relevance to obesity in African American adults and based on previous studies in adults.[24]

Our study used multiple imputation[25] to address all missing data in the PATH trial, consistent with previous national trials.[26] The MICE package[27] implemented within R statistical

Table 1. Linear regression analysis for body mass index

		Unstandardized Coefficient		Standardized Coefficient		
Step	Variable	B	SE	B	T	R^2
1	Intercept	32.07	1.73		18.56[b]	.15
	Age	-.04	.03	-.06	-1.28	
	Sex	4.28	.85	.25	5.02[b]	
	MVPA	-.05	.01	-.24	-4.56[b]	
	Community	-.24	.49	-.02	-.50	
2	Peer social support	.34	.39	.04	.87	.17
	Neighborhood social interaction	-.14	.07	-.10	-2.08[a]	
	Neighborhood satisfaction	-.97	.60	-.08	-1.61	
	Places for walking/cycling	.67	.48	.07	1.39	
	Perceptions of safety	-.71	.66	-.05	-1.07	

B, beta; SE, standard error; T, t-value.
a. $P<.05$.
b. $P<.001$.

program (R Foundation, 2008) was used to generate 20 imputations. No differences were observed between participants in the analysis sample for the primary outcome and those excluded on any other covariates. All other statistical analyses were conducted in SPSS Version 19. Assumptions for regression were tested prior to running analyses (linearity, independence, homoscedasticity and normality), and were met.

Results

Participant Characteristics

In our study population, 63% were women, with a mean age of 52 (*SD*=15) years. On average, participants were overweight or obese as indicated by BMI (*M*=31.18, *SD*=8.41). Approximately two thirds of the study participants (65.0%) made <$25,000 and completed less than one year of college (68.5%). Finally, the overall sample was classified as prehypertension with systolic BP (*M*=132.80, *SD*=17.85) and diastolic BP (*M*=81.36, *SD*=10.93).

Correlation Analysis

Correlation analyses were conducted to examine the relationships between demographic, social and environmental variables and BMI. As expected, MVPA was correlated with age (*r*=-.39, *P*<.001), sex (*r*=-.36, *P*<.001) and BMI (*r*=-.31, *P*<.001). BMI was also significantly inversely associated with neighborhood social interaction (*r*=-.13, *P*<.01).

Regression Analysis

The results of the linear regression are reported in Table 1. The regression for BMI was significant for the overall model (F[11, 405]=7.81, *P*<.001) and accounted for 17.5% of the variance in BMI. Results indicated that sex (B=4.28, *P*<.01), neighborhood social interaction (B=-.14, *P*<.05), and MVPA (B=-.05, *P*<.001) were significantly associated with BMI. Females, adults with lower neighborhood social interaction, and adults with lower minutes of MVPA all had a larger BMI than males, those with higher neighborhood social interaction or higher MVPA, respectively.

Discussion

Our study demonstrated that neighborhood social interaction and average daily MVPA were significantly predictive of BMI in a sample of underserved, African American adults. Sex was also significantly predictive of BMI in the expected direction with males showing higher values than females. Interestingly, the other neighborhood factors including places to walk/bike, perceptions of safety and neighborhood satisfaction did not significantly predict BMI. Peer social support was also not a significant predictor of BMI. These results highlight the importance of neighborhood social interaction as compared to other bioecological factors (including, neighborhood safety and infrastructure) in predicting weight-related measures, especially in underserved African Americans, although the overall variance accounted for was quite small.

The results from our study suggest the importance of neighborhood social interaction on, and neighborhood satisfaction in, understanding weight-related measures in African American adults. This is a novel finding, particularly because very little previous research has specifically examined these types of neighborhood factors in predicting weight-related measures. These findings are consistent with previous studies on social environmental predictors of PA among non-minority populations. For example, Fisher and colleagues[28] found that adults in socially cohesive neighborhoods were more likely to report higher levels of walking than those who were in less cohesive neighborhoods. Additionally, King[29] found that older adults who perceived their neighborhood to have a higher leverl of

Our study demonstrated that neighborhood social interaction and average daily MVPA were significantly predictive of BMI in a sample of underserved, African American adults.

social cohesion reported higher levels of PA, than those who reported lower levels of neighborhood social cohesion. Further research, however, should continue to investigate the relationship between neighborhood social interactions/social environment and weight-related measures in addition to PA outcomes in the context of developing health promotion interventions in underserved communities.

Our study found that neighborhood social interaction was critical in predicting BMI. Our findings are consistent with past work by McNeill and colleagues[30] who identified five dimensions of social environment, including: 1) social support and social networks; 2) socioeconomic position and income inequality; 3) racial discrimination; 4) social cohesion and social capital; and 5) neighborhood factors (generally built environment) as critical for PA outcomes. While this is a framework for dimensions of social environment focused on PA, research is needed to test these dimensions for weight-related measures. While our study did not find social support as predictive of weight-related measures, it may be that neighborhood social interaction and satisfaction are more critical than special peer social support. Neighborhood social interactions were shown to be critical in our study, which is a similar construct to social cohesion and social capital that have also been associated with better weight-related measures in past studies. For example, Wilkinson[31] found that societies who were more socially integrated and cohesive experienced better health outcomes, specifically lower mortality and longer life expectancy, than those societies that were less integrated and cohesive. Thus, our work continues to support the growing evidence that neighborhood social life may be key for improving health outcomes in underserved African American communities.

Further support for social influences on health outcomes has also been supported by several national studies. Berkman and Syme[32] found that those individuals who were more isolated socially and had less community ties showed higher mortality relative risks of 2.3 (men) and 2.8 (women) compared with those with more social ties. Individuals with fewer social ties were also more likely to be obese. In another study, Cohen et al[33] found that neighborhoods of low collective efficacy (-1 SD of mean) had higher odds ratios of 2.71 for at risk for overweight, and odds ratios of 2.32 for being overweight, compared to neighborhoods with high levels of collective efficacy (+1 SD). Finally, Cohen and colleagues[9] found that the relationship between concentrated disadvantage and all-cause premature mortality was mediated by neighborhood collective efficacy. Further, they reported that in the neighborhoods that reported low vandalism scores, collective efficacy was a protective factor for premature mortality, while in neighborhoods with high vandalism scores there was no effect. Taken together these findings highlight the importance that neighborhood social factors have on weight-related measures in underserved adults.

Our study supports innovative work on social and environmental neighborhood effects on BMI and suggests that extending these approaches in underserved communities may be important for reducing health disparities. Brown and colleagues[34] examined several variables and developed a new construct, neighborhood social climate in relation to health measures. This social climate included positive and negative neighboring behavior (ie, supportive acts of neighboring, neighborhood attachment, neighbor annoyance and informal social ties). In this longitudinal study, they found that those who reported more positive neighborhood social climate were 2.57 times more likely to have walked in the last week of the 12-month follow-up, compared with those who reported more negative neighborhood social climate. Additionally, Brown et al[34] postulated that individuals with a network of support and opportunity for neighborhood social interactions would lead to having a more positive perception of their neighborhood, thus leading to more PA and better health outcomes. However, while the findings by Brown et al[34] are crucial for understanding the impact of one's neighborhood social climate, future research is needed to better understand these effects on weight-related measures directly using longitudinal and intervention study designs.

Although our study was not consistent with previous studies on

the built environment, an increasing number of studies have evaluated the negative associations of the built environment and BMI.[19,35] Additionally, although previous studies found safety as a predictor,[11,12] our study did not show the association of perceptions of safety on BMI. Although the aforementioned studies found that built environment was predictive of BMI, our study showed that social neighborhood factors were important but that the built environment was not significantly associated with BMI measures in underserved African American communities.

Furthermore, our study did not find peer social support to predict weight outcomes either. This study adds to the literature given that few studies have investigated peer social support in reference to weight-related measures in underserved African Americans. However, more research is needed because a previous weight loss intervention with African American females found social support to be important.[36] Future research should continue to investigate in greater detail social factors and perhaps sex differences (social interactions, social connectedness, and social cohesion and climate) to better understand weight outcomes, particularly in underserved populations.

Limitations

There were several limitations to this study. First, since our study was cross-sectional, no causal relationships can be inferred from these findings. Therefore, future studies should work toward investigating weight outcomes longitudinally. Another limitation is that the effect size of neighborhood variables was fairly small. However, these results are consistent with previous studies that have shown similar effect sizes within this population.[28,29] Next, while our study did use community as a covariate, it analyzed all data at an individual level and did not account for clustering of neighborhood social factors. Additionally, limited generalizability may be a factor because this study included only three communities in the southeastern United States, and thus other regions may be different. Since our study was based in low-income, high crime communities, the generalizability is also limited to this type of community. Another factor that impacts the generalizability is the participants in this study were part of a larger study that only included participants without severe limitations or uncontrolled chronic disease. It may be important for future studies to enroll a broader range of participants to expand generalizability. Although there are limitations to our study, this is one of the first studies to demonstrate the importance of social environmental factors on influencing BMI in underserved African American adults.

Conclusion

Our study contributes to limited research on neighborhood social environmental predictors of weight-related measures in underserved, African American adults. Our study showed that a significant predictor for BMI in African American adults in low-income neighborhoods was their neighborhood social interactions. Although previous literature suggests the importance of peer social support, places for walking/cycling, and perception of safety, these factors were not predictive of weight outcomes in our study sample. Ultimately, neighborhood social interactions could be important and future research should integrate the social component of neighborhood composition into interventions that target weight–related measures in underserved African American adults.

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Author Contributions

Research concept and design: McDaniel, Wilson, Coulon. Acquisition of data: Wilson, Coulon. Data analysis and interpretation: McDaniel, Wilson, Hand, Siceloff. Manuscript draft: McDaniel, Wilson, Siceloff. Statistical expertise: McDaniel, Wilson, Coulon, Siceloff. Acquisition of funding: Wilson. Administrative: McDaniel, Wilson. Supervision: Wilson, Hand.

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