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Obesity and Neighborhood Collective Efficacy:
A Site Comparison between San Juan, Puerto Rico and the South Bronx, New York

By

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Master of Public Health

Epidemiology

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B.S.

University of Wisconsin, Madison

2018

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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Abstract

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By Yi Ting (Hana) Lee

Objective

Among the Hispanic/Latino population, Puerto Rican adults have the highest prevalence of obesity and smoking rates, which increase the risks of cardiovascular diseases. Individual- and neighborhood-level factors can both influence health outcomes of individuals and populations. Compared to the built environment, there is less understanding about how the social environment can influence the development of obesity. Collective efficacy, an aspect of the social environment, is defined by informal social control and social cohesion. Our study aims to understand the association between neighborhood collective efficacy and obesity among Puerto Ricans and to examine whether the association differs between Puerto Rico and New York.

Methods

We analyzed data from the Boricua Youth Study—Healthy Heart Assessment, which included a subsample of wave 4 of the longitudinal Boricua Youth Study. The participants were identified as having a Puerto Rican background by a family member at baseline and were in their 20s. The outcome measures were obesity (BMI≥30) and high waist circumference (>40 inches for male, >35inches for female). We used log binomial regression models in the stratified analyses to estimate the prevalence ratio of obesity and high waist circumference across sites with collective efficacy as a continuous and categorical exposure. The models were adjusted for age, gender, maternal education, receipt of public assistance in the last year, current residency, neighborhood hazards, neighborhood walkability and neighborhood safety.

Results

The association between neighborhood collective efficacy and obesity outcomes were different between the sites. In Puerto Rico, neighborhood collective efficacy was found to be positively associated with obesity and high waist circumference. In New York, as neighborhood collective efficacy increased, the prevalence of obesity and high waist circumference decreased.

Conclusion

The findings suggest that how neighborhood environment impacts obesity prevalence may depend on the location and context. The differential associations indicate that there are various pathways through which collective efficacy may affect obesity. To effectively prevent obesity, we need to understand the mechanisms and address the environment in interventions.

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INTRODUCTION

Over the last decade, the Hispanic/Latino population in the United States has grown significantly and is projected to continue to increase (Ennis et al., 2011). The group encompasses a diversity of ethnicities that cover various geographical regions. The consideration of the Hispanic/Latino population as an aggregated and homogenous group in research often overlooks the disparities in prevalence, risk factors and health outcomes among the various ethnic groups (Manjunath et al., 2019). Studies have examined health outcomes and risk factors across various Hispanic/Latino groups and documented the differences in the prevalence of cardiovascular diseases (CVD) and risk factors, as well as differential association between subclinical CVD and risk factors (Daviglus et al., 2012; Flegal et al., 1991; Allison et al., 2008; Isasi et al., 2015).

Disparities in Obesity Among Hispanic/Latino Population

Among the Hispanic/Latino population, Puerto Ricans are the second largest and fastest growing group (Arevalo et al., 2014; Ennis et al., 2011). Particularly, Puerto Rican adults have the highest obesity and smoking rates and the highest prevalence of having three or more age- and sex-adjusted CVD risk factors compared to adults of Cuban, Dominican, Mexican, Central American and South American backgrounds (Daviglus et al., 2012). The population-difference in obesity prevalence is alarming with Puerto Rican adults having almost two times the prevalence of extreme obesity compared to adults of other Hispanic/Latino backgrounds (Isasi et al., 2015).

The differences in weight status are also observed among Hispanic/Latino youths. A longitudinal study on the trajectories of body mass index (BMI) found that when all groups of Hispanic/Latino youths were compared to non-Hispanic white youths, youths of Puerto Rican and Mexican descent had the largest increase in BMI in both adolescence (ages 12 to 20) and adulthood (ages 20+). The increase in BMI trajectories was still present after adjusting for individual social and behavioral factors, including socioeconomic status (SES), parental education, generation of immigration, physical activity, screen time and current smoking status (Albrecht et al., 2013). The findings suggest that sociocultural and environmental factors beyond the individual level may meaningfully influence the change in adolescent BMI.

Neighborhood Context

The distributions of health status and health outcomes are influenced by both individual- and neighborhood-level characteristics (Cohen et al., 2008). The recent increased emphasis on social determinants of health has stimulated researchers' interests in understanding how neighborhood- and ecological-level factors affect health. This shift in research focus builds on the concept of place-based health, which has been around since the 80s and 90s, and helps inform interventions to address health disparities (Diez Roux, 2001; Dankwa-Mullan & Pérez-Stable, 2016). Neighborhood-level factors such as education, income/wealth, employment status, type of housing, physical infrastructure and social environment have been examined in relation to birthweight (Rajaratnam et al., 2006; Pearl et al., 2001), exposures to environmental risk factors (Evans & Kantrowitz, 2002), physical activity (Kimbro et al., 2011; Carroll-Scott et al., 2013), obesity (Ewing et al., 2006; Cohen et al., 2006; Frank et al., 2004) and access to healthy foods (Horowitz et al., 2004).

The neighborhood environment consists of two large domains: the physical or 'built' environment and the social environment (Yen & Syme, 1999). The dimensions of the built environment such as walkability, access to recreational spaces and density of fast food outlets have implications on youths' level of physical activity and nutritional intake (Carroll-Scott et al., 2013). Adolescents who lived in areas with more fast food outlets were found to have higher BMI and engaged in unhealthy eating more frequently than those who lived in areas with less availability to fast food (Carroll-Scott et al., 2013). Furthermore, as urban sprawl increased, decreasing walkability, the odds of adolescents being overweight or at risk of overweight increased (Ewing et al., 2006). Environments that encourage physical activity and healthy eating are crucial to obesity prevention and interventions on the obesity epidemic. Infrastructures, such as parks and sidewalks (Suglia et al., 2016), and aspects of urban designs like mixed land-use and walkability (Frank et al., 2004) can promote physical activity and have positive implications on obesity prevention. Understanding the impact of the food environment and increasing the affordability and accessibility of healthy foods in neighborhoods are important to improving the dietary behaviors of residents (Horowitz et al., 2004).

Addressing the food environment may be particularly important in low SES and majority racial/ethnic minority neighborhoods, which often experience disparities in resource distribution and have disproportionally higher prevalence of obesity compared to affluent neighborhoods (Horowitz et al., 2004). Studies have also pointed to the importance of social and socioeconomic characteristics of neighborhood environment on health (Carroll-Scott et al., 2013). One study used data from the Healthy Communities Study, which sampled 130 neighborhoods across the US, and found an interaction between neighborhood- and family-SES. In the study, high-income children in neighborhoods with a history of high SES had the lowest obesity indicators and an increased frequency of physical activity compared to children in other neighborhoods. Neighborhood SES may affect children's obesity and physical activity through built and social environments (Kim et al., 2020). Another study found the associations between mixed land-use and transportation pattern and BMI differed between Black and White populations, suggesting the role of underlying social factors (Frank et al., 2004). The differential associations between built environment and obesity among adults of different racial backgrounds, and the interaction between neighborhood- and family-SES in obesity outcomes among children suggest the potential role of neighborhood social environment on the development of obesity.

Neighborhood Social Environment

The social environment encompasses the relationships, socioeconomic resources and social processes of the groups we belong to and the neighborhoods we live in (Yen & Syme, 1999, Carroll-Scott et al., 2013; Suglia et al., 2016). The physical and social neighborhood environment interact with one another and together impact the health of residents in complex ways (Cohen et al., 2008). Certain characteristics of the physical environment can modify social networks, interactions between residents, and residents' perceptions of the neighborhood, and therefore affecting health outcomes (Cohen et al., 2008; Diez Roux, 2001). Meanwhile, social capital, which is the collective networks and resources held by a group of individuals, and collective efficacy are components of the social neighborhood environment that may affect the built environment (Cohen et al., 2006; Cohen et al., 2008). A neighborhood with high level of social capital and high level of collective efficacy, may be more willing to intervene and take political actions to ensure that their neighborhood is walkable, safe and has less fast food outlets (Cohen et al., 2006; Cohen et al., 2008).

Among adolescents, healthy eating behaviors have been associated with neighborhood characteristics such as higher concentration of wealth, more social ties, fewer fast food outlets and greater perceived access to recreational spaces (Carroll-Scott et al., 2013). These findings indicate that the neighborhood social and built environment are interconnected. However, there is no clear evidence on how the built environment and the social environment act together to produce health outcomes.

Compared to the built environment, there is less knowledge about the impact of the social environment on obesity (Suglia et al., 2016; Yen & Syme, 1999). The social environment has been examined through several aspects including informal social control, level of community involvement, social capital, social norms, social trust, collective efficacy, neighborhood disorder, neighborhood hazards and segregation (Rajaratnam et al., 2006; Suglia et al., 2016; Subramanian, 2002; Sampson, 1997). Social trust at the community-level was associated with individuals' self-reported health status (Subramanian, 2002). Among those who reported higher-levels of trust, the increase in community-level trust was protective and there was a decrease in the probability of poor self-reported health status (Subramanian, 2002). Similarly, after adjusting for individual-level covariates, social capital at the state-level was associated with lower odds of obesity and physical inactivity (Kim et al., 2006). However, the mechanisms through which neighborhood social attributes affect health vary and some characteristics may be more pertinent to certain health outcomes (Diez Roux, 2001).

Collective Efficacy

Collective efficacy is defined by two dimensions: informal social control and social cohesion (Sampson, 1997). Informal social control is how likely neighbors are to intervene on emergencies or to discipline children in the neighborhood while social cohesion is the mutual trust and willingness amongst residents to act together (Sampson, 1997; Cohen et al., 2008).

Neighborhood collective efficacy has been associated with a range of health outcomes including violence (Sampson, 1997), all-cause premature mortality (Cohen et al., 2003), cardiovascular disease-related mortality (Lochner et al., 2003), health behaviors (Kimbro et al., 2011) and adolescent obesity (Cohen et al., 2006). However, the relationship between collective efficacy and obesity prevalence is not consistent in literature. Burdette et al. (2006) found that lower levels of perceived collective efficacy was associated with higher mean BMI and higher prevalence of obesity among women from the Fragile Families and Child Wellbeing Study. However, after adjusting for individual level covariates including income, level of education, race/ethnicity, current marital status, smoking status and history of major depressive episode in the past 12 months, there was no clear association between collective efficacy and mean BMI. In contrast, Cohen et al. (2006) found that higher levels of neighborhood collective efficacy are associated with lower BMI among adolescents, after adjusting for neighborhood-level characteristics (percent poverty and percent households with a female head) and individual-level characteristics (marital status and education attainment of primary caregivers, and age, race/ethnicity and sex of adolescents). For residents in neighborhoods with collective efficacy one standard deviation below the mean, they are 52% more likely to be overweight compared to their counterparts in neighborhoods with average collective efficacy (Cohen et al., 2006).

While the measure of collective efficacy does not directly capture information on dietary patterns or physical activity, this component of the neighborhood may indirectly affect factors related to obesity (Cohen et al., 2006). Neighborhood collective efficacy has been positively associated with parks and recreational spaces while being negatively associated with alcohol outlets (Cohen et al., 2008). Additionally, a higher level of collective efficacy was associated with increased outdoor play, which was associated with lower BMI among young children in urban areas (Kimbro et al., 2011). It is possible that neighborhood collective efficacy can impact the built environment, creating either an obesogenic or a healthy environment that influences residents' health behaviors.

Another potential mechanism through which collective efficacy could impact obesity is through the biological stress response system. Residents in neighborhoods with low collective efficacy may be exposed to stressors more frequently and have less social support from the community (Cohen et al., 2006). Stress has been associated with increased cortisol excretion (Cohen et al., 2006) and increased food intake as a coping behavior (Burdette et al., 2006). The effects of chronic exposure to stress in daily life and high cortisol excretion accumulate over time and can lead to the dysregulation of the metabolic systems, increasing the risk of obesity and other chronic conditions (Arevalo et al., 2014).

In the literature, measures of social context have been inconsistent and there are theoretical, methodological and practical barriers that should be considered in measurement (Rajaratnam et al., 2006). The most common approach in examining the relation between neighborhood context and health is often to combine various neighborhood context measures and create an index measure (Rajaratnam et al., 2006). This approach prevents us from understanding the details and the mechanisms through which neighborhood characteristics influence health outcomes (Rajaratnam et al., 2006). Krieger et al. (2002) argued that the utilization of single indicators can better explain the underlying mechanisms. Single indicators have demonstrated performances just as effective as composite socioeconomic measures at both the individual- and area-level (Krieger et al., 2002).

Often, social neighborhood characteristics are measured based on the residents' perception. Sampson (1997) developed a 10-item Collective Efficacy Scale that asks residents to rate various aspects of social control and cohesion. The scale has been widely used in studies examining collective efficacy (Burdette et al., 2006; Cohen et al., 2003; Cohen et al., 2006; Cohen et al., 2008; Kimbro et al., 2011; Molnar et al., 2004; Sampson et al., 1999).

Boricua Youth Study Healthy Heart Assessment

The Boricua Youth Study—Healthy Heart Assessment (BYS-HA) sampled two populations of Puerto Ricans in two different geographic locations—metropolitan areas of San Juan, Puerto Rico (PR) and the South Bronx, New York City (NY), which has the largest Puerto Rican population in mainland US (Ennis et al., 2011).

Unlike other Hispanic and Latino groups, Puerto Ricans are US citizens (Arevalo et al., 2014). However, the cultural and linguistic differences Puerto Ricans experience in internal migration from the island to mainland US is similar to the experiences of Hispanic/Latino immigrants (Arevalo et al., 2014). The stress related to acculturation, social isolation, economic difficulties and discrimination after migration to mainland US have implications on health trajectories over the life course (Arevalo et al., 2014).

The Bronx, one of the five boroughs of New York City has some of the worst economic, social and health outcomes, including high asthma, unemployment and poverty rate compared to the other boroughs in NYC (Office of the State Deputy Comptroller for the City of New York, 2018). Puerto Ricans in the Bronx have the highest prevalence of obesity compared to Puerto Ricans in other major US cities (Isasi et al., 2015). In comparison, Puerto Rico has high poverty and unemployment rate, and has been struggling to maintain an under-funded healthcare system (Benson & Bishaw, 2019; Roman, 2015). In addition to the geographical differences, the social contexts differ between PR and NY. In NY, Puerto Ricans are considered the minority in the population whereas in PR, they are considered the majority in the population.

Our study aims to understand the association between neighborhood collective efficacy and obesity among Puerto Ricans, who have the highest burden of obesity among Hispanic/Latino groups (Daviglus et al., 2012; Manjunath et al., 2019). Since neighborhood characteristics are location-dependent and given the significant differences in demographics, socioeconomic factors and local contexts, we will also examine whether this association differs between PR and NY. While some literature supports the association between neighborhood collective efficacy and obesity, it is possible that the association is location dependent. To our knowledge, no studies have analyzed the association between neighborhood collective efficacy and obesity prevalence among a Hispanic/Latino group across two geographical contexts. Furthermore, studies have examined collective efficacy among adults and children, but none have studied young adults, who are between the two life stages. The findings of this study can potentially bring insights to the role of collective efficacy in shaping obesity among a high prevalence population and highlight the importance of interventions that are tailored to the local context.

METHODS

Study Design

The Boricua Youth Study (BYS) started in 2001, with waves 1, 2 and 3 occurring between 2001 and 2004 when the participants were ages 5 to 13. A fourth wave of data collection occurred between 2012 to 2017 when the participants were ages 17 to 26. At baseline, the study included 2491 participants ages 5 to 13 across the South Bronx, NY and the metropolitan areas of San Juan, PR (Bird et al., 2006). The participants were drawn from multistage probability samples and were representative of the target population at both sites (Bird et al., 2006). Household eligibility criteria included 1) having at least one child who is between ages 5 to 13 and was identified as having Puerto Rican background by a family member 2) having at least one of the child's parents or primary caretakers living in the same household, and also identified as having Puerto Rican background (Bird et al., 2006). In each household, up to three children were selected to participate and if the household had more than three children, then three children were randomly selected (Bird et al., 2006). The exclusion criteria included children who had been diagnosed with developmental delays or mental disabilities, and children who had not lived in the specific household for at least 9 months prior to the study due to concerns over whether the caregiver could provide thorough information about the children (Bird et al., 2006). Further details regarding the BYS study design can be found in Bird et al., 2006.

The fourth wave of BYS occurred from 2013 to 2017 and included 2004 participants (80%) from waves 1-3 (Duarte et al., 2020). The BYS-HA is a cross-sectional study that is part of the longitudinal BYS. The purpose of the BYS-HA study was to understand early cardiovascular disease risk factors. BYS-HA surveys were conducted among cohort participants rather than their parents or primary caregivers.

Data collection for BYS-HA occurred between 2014 and 2019, and included 80% of eligible participants who completed the BYS wave 4. The eligible sample only included participants who were ages 5 to 10 at baseline of BYS due to developmental considerations. The sample size in BYS-HA was 731 participants, with ongoing data collection. There were 393 participants in PR and 338 participants in NY. Data collection was conducted by trained researchers, with at least a bachelor's degree, during home visits. The quality of the interviews was ensured by field supervisor's review and evaluation, and all interviews were audiotaped for spot-check.

Collective Efficacy

The exposure of interest, neighborhood collective efficacy, was measured with a 7-item questionnaire that probes interpersonal relationships between individuals in a neighborhood. The scale used is a modified version of the 10-item Collective Efficacy Scale created by Sampson (1997), which has been used in several studies examining the impact of neighborhood on a range of health outcomes (Stanford University). The measure includes two parts: informal social control and social cohesion. This scale requires a reading level of 6^{th} grade or less (Stanford University). The neighborhood collective efficacy 7-item measure include: 1) People in {neighborhood} can be trusted 2) People in {neighborhood} generally get along with each other 3) I have neighbors who would help me if I had an emergency 4) People in {neighborhood} look out for each other 5) People in {neighborhood} help each other out when there are problems 6) People in {neighborhood} watch out for each other's children 7) I know the names of people in {neighborhood}. Respondents answered each item using a four-point rating scale (1=very true, 2=somewhat true, 3=not very true, 4=not at all true). All items were reverse coded and the scores for all seven items were summed to create a total score. A higher total collective efficacy score indicated a higher level of perceived neighborhood collective efficacy.

Weight Status

Height, weight and waist circumference were measured during home visits by trained interviewers. All measurements were taken twice, and the averages were calculated. Participants removed thick clothing such as jackets and were asked to stand with heels together and arms slightly out while maintaining normal breathing. To assess waist circumference, participants were asked to locate their hipbones, and the tape measure was wrapped slightly above the top of the hipbones while being parallel to the floor. The participants exhaled normally so there was no excess measurement. Waist circumference was dichotomized based on the guidelines from the Centers for Disease Control and Prevention (CDC) (CDC, 2020). A waist circumference greater than 40 inches for men and a waist circumference greater than 35 inches for non-pregnant women indicate excessive abdominal fat, which increases the risks of developing cardiometabolic conditions.

BMI was calculated from the measured height and weight using the formula below:

$$BMI = \frac{[Weight\ in\ lbs * 703]}{[height\ in\ inches]^2}$$

BMI was categorized based on the guidelines from CDC (CDC, 2020). For adults 20 years old and above, a BMI of 18.5 to 24.9 is considered normal and healthy weight, a BMI of 25.0 to 29.9 is considered overweight and a BMI of 30.0 and above is considered obese. BMI was dichotomized as obese (BMI ≥30) and non-obese (BMI <30).

Covariates

We adjusted for individual and neighborhood factors. Individual factors included age, gender, SES and current residency, which reflected participants' housing arrangement. SES was adjusted using two variables—maternal education and receipt of public assistance in the last year because the participants were in their 20s and most were still financially dependent on their parents/caregivers. Current residency was categorized as "in a parent/caretaker's home", "on their own or with a friend/acquaintance", or "in other housing arrangements".

Aspects of the neighborhood environment were controlled for by adjusting neighborhood hazards, neighborhood safety and neighborhood walkability. The neighborhood hazards 10-item measurement was adapted from the scale developed by Aneshensel and Sucoff (1996) and included items on pollution, traffic, trash, violence and lack of access to parks, quality education, healthcare, grocery stores, entertainment, and government services. A similar scale to assess perceived neighborhood hazards was used in Romero et al. (2001). All items were reverse coded, so a higher score indicated a more hazardous neighborhood. Neighborhood safety was assessed with one question "How safe do you think {neighborhood} is?" and a three-point rating scale (0=very safe, 1=neither safe nor unsafe, 2=very unsafe). The item was reverse coded, so a higher score indicated higher perception of neighborhood safety. The neighborhood walkability scale included 14-items on the easiness to walk in the neighborhood as well as perception of safety when walking. This walkability scale was similar to the 64-item Neighborhood Environment

Walkability Scale (NEWS) developed by Cerin et al. (2006). Some items were reverse coded, so the higher the score, the more walkable the neighborhood was.

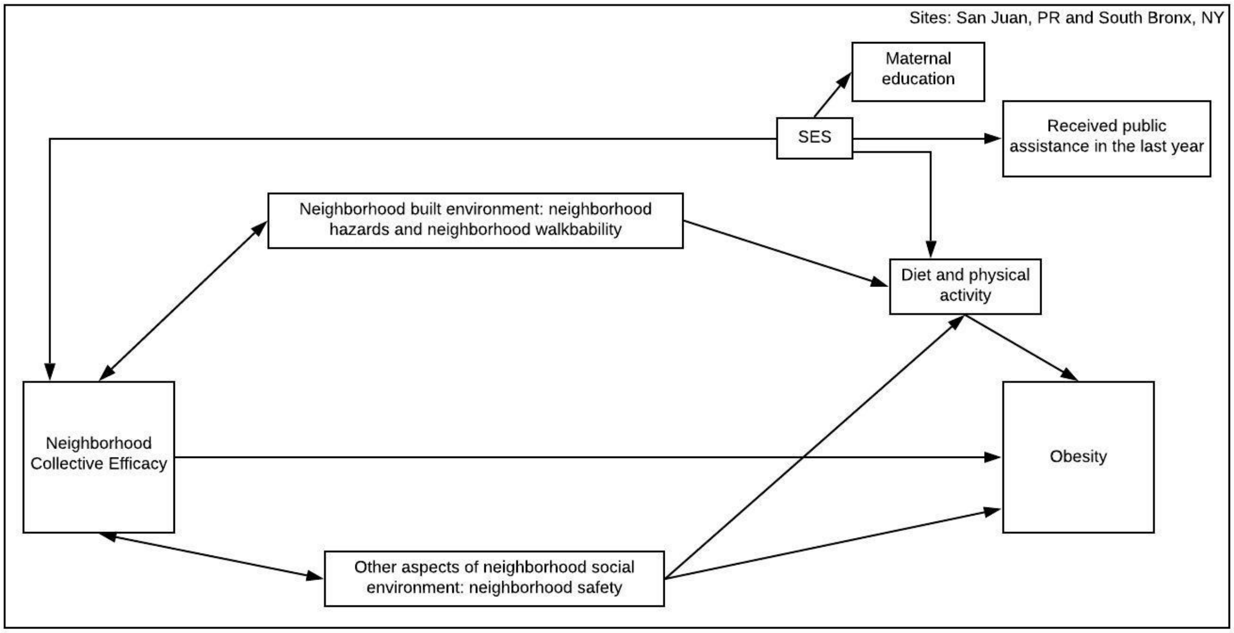

Figure 1. A conceptual model of the relation between neighborhood collective efficacy and obesity.

Statistical Analysis

We conducted log binomial regression to determine the association between neighborhood collective efficacy and obesity (BMI≥30) and high waist circumference (>40in for males, >35in for females). We hypothesized differences in the association between neighborhood collective efficacy and obesity and high waist circumference by site (Figure 1), so stratified analyses were conducted to estimate the prevalence ratio of obesity and high waist circumference for each site. To examine confounding by individual and neighborhood factors separately, we compared model 1, which was adjusted for individual factors only (age, gender, maternal education, receipt of public assistance and current residency) and model 2, which was adjusted for neighborhood factors only (hazards, walkability and safety). We also conducted a third model that adjusted for both individual- and neighborhood-level factors. Models 1-3 examined collective efficacy as a continuous exposure.

Collective efficacy was also examined as a categorical variable. In model 4, the tertile cutoffs were determined from the summed collective efficacy score in the overall dataset to allow comparison across the same categories between sites. Collective efficacy was categorized as low (≤18.0), medium (18.1 – 24.9) and high (≥ 25.0). In model 5 and model 6, we categorized collective efficacy using site-specific cutoffs. Collective efficacy was categorized as low (≤20.0), medium (20.1-26.9) and high (≥27.0) in PR, and low (≤17.0), medium (17.1-21.9) and high (≥22.0) in NY. Models 4-6 were adjusted for both individual- and neighborhood-level factors.

All models were adjusted for SES using selected variables—maternal education and receipt of public assistance in the last year. We compared the robustness of the findings adjusted for SES using selected variables to the findings adjusted for SES using a propensity score variable (PSCAT Index), which included maternal education, family income and family structure.

RESULTS

Descriptive Statistics

The final analytic sample included 655 participants, with 351 (51.3% female) in PR and 304 (49.0% female) in NY. Nine participants were missing information on age, sex and receipt of public assistance in the last year, 32 were missing maternal education, 12 were missing current residency, 10 were missing neighborhood hazards, walkability and collective efficacy, 13 were missing neighborhood safety, 37 were missing BMI and 40 were missing waist circumference measure. There were differences in gender distribution, maternal education level and receipt of public assistance between those excluded for missing data and those included in the analytic sample.

The mean age of participants was 22.43 years (SD 1.85) in PR and 22.66 years (SD 1.94) in NY. The majority of the participants lived at their parent's or caretaker's home (67.8% in PR and 68.4% in NY) and received public assistance in the last year (63.0% in PR and 64.5% in NY). There were no significant differences in gender distribution, average age, current residency and receipt of public assistance in the last year between the sites. In PR, there was a higher percentage of biological mothers who have completed high school/GED or more (74.6%) compared to NY (51.6%).

The average BMI was 25.22lb/in^2 (SD 6.62) in PR and 28.08lb/in^2 (SD 7.65) in NY ($p < 0.05$). The prevalence of obesity (BMI $\geq$ 30.0lb/in^2) was 20.5% in PR and 34.9% in NY ($p < 0.05$). In PR, 17.5% of males had high waist circumference (>40 inches) and 45.0% of females had high waist circumference (>35 inches), compared to 30.3% males and 60.4% females in NY ($p < 0.05$). The neighborhood measures were different across sites. Compared to PR, NY had higher levels of neighborhood hazards (19.14, SD 5.98) and walkability (43.50, SD 5.14), and lower levels of collective efficacy (19.44, SD 4.40) and safety (1.22, SD 0.66) ($p < 0.05$).

Correlation Between Neighborhood Measures

In PR, neighborhood hazards appeared to be moderately negatively correlated with neighborhood walkability (r=-0.47) and neighborhood safety (r=-0.40), and was weakly negatively correlated with neighborhood collective efficacy (r=-0.32). Neighborhood walkability had weak positive correlations with neighborhood safety (r=0.21) and neighborhood collective efficacy (r=0.25). Collective efficacy was weakly correlated with safety (r=0.36) (Table 2). In NY, neighborhood hazards had weak negative correlations with walkability (r=-0.34) and collective efficacy (r=-0.19), and moderate negative correlation with safety (r=-0.52). Neighborhood walkability had weak positive correlations with collective efficacy (r=0.30) and safety (r=0.26). Collective efficacy had weak positive correlation with neighborhood safety (r=0.24) (Table 2). All Pearson correlation coefficients for neighborhood measures were statistically significant ($p < 0.05$).

Neighborhood Collective Efficacy and Obesity

In stratified analysis, as neighborhood collective efficacy increased by 1 unit in PR, the unadjusted prevalence of obesity (BMI ≥ 30) increased by 1.02 times (95% CI: 0.97, 1.07). The prevalence of obesity increased by 1.02 times (95% CI: 0.98, 1.07) after adjusting for individual factors only, and 1.03 times (95% CI: 0.98, 1.09) after adjusting for neighborhood factors only (Table 3). After adjusting for both individual and neighborhood measures, the prevalence of obesity increased by 1.04 times (95% CI: 0.98, 1.09) and the prevalence of high waist circumference increased by 1.01 (95% CI: 0.98, 1.05) with every 1 unit increase in collective efficacy (Table 4).

For NY, the stratified analysis found that as neighborhood collective efficacy increased by 1 unit, the unadjusted obesity prevalence decreased by 3% (95% CI: 0.94, 1.00). The prevalence of obesity was the same after adjusting for individual factors and neighborhood factors separately (Table 3). After adjusting for both individual and neighborhood measures, the prevalence of obesity and high waist circumference decreased by 3% (95% CI: 0.94, 1.00) with every 1 unit increase in collective efficacy (Table 4).

Sensitivity Analysis

The association between neighborhood collective efficacy and obesity was also examined with collective efficacy as a categorized exposure. In PR, the prevalence of obesity among those living in neighborhoods with medium collective efficacy was 14% (95% CI: 0.46, 1.63) lower than the prevalence of obesity among those living in neighborhoods with low collective efficacy (Model 4, Table 4). Among those living in neighborhoods with high collective efficacy, the prevalence of obesity was 1.55 times (95% CI: 0.82, 2.90) the prevalence of obesity among those living in neighborhoods with low collective efficacy (Table 2). In NY, the prevalence of obesity among those living in neighborhoods with medium collective efficacy was 20% (95% CI: 0.58, 1.11) lower than the prevalence of obesity among those living in neighborhoods with low collective efficacy (Model 4, Table 4). Among those living in neighborhoods with high collective efficacy, the prevalence of obesity was 36% (95% CI: 0.35, 1.15) lower than that of those living in neighborhoods with low collective efficacy.

In PR, when collective efficacy was categorized using site-specific tertile cutoffs (Model 5), we found that among those living in neighborhoods with medium and high collective efficacy the prevalence of obesity was 1.25 times (95% CI: 0.73, 2.14) and 1.57 times (95% CI: 0.86, 2.85) higher than the prevalence of obesity among those living in neighborhoods with low collective efficacy (Table 5). The prevalence of high waist circumference was 1.14 times (95% CI: 0.80, 1.62) and 1.34 times (95% CI: 0.86, 2.09) higher among those living in medium and high collective efficacy neighborhoods compared to those living in low collective efficacy neighborhoods. In model 6, collective efficacy was categorized using tertile cutoffs specific to NY. The prevalence of obesity among those in medium and high collective efficacy neighborhoods in NY was 11% (95% CI: 0.62, 1.27) and 32% (95% CI: 0.44,1.04) lower than the prevalence of obesity among those living in low collective efficacy neighborhoods (Model 6, Table 5). Among those living in medium and high collective efficacy neighborhoods, the prevalence of high waist circumference was 16% (95% CI: 0.64,1.09) and 26% (95% CI: 0.55, 0.99) lower than that of those living in low collective efficacy neighborhoods.

To test the robustness of the findings controlled for the selected SES variables –maternal education and receipt of public assistance in the last year, we repeated the analysis using the propensity score (PSCAT Index) created from maternal education, family income and family structure. The results were similar indicating that the selected variables appropriately reflected individuals' SES (Table 6).

DISCUSSION

Our study found that the association between collective efficacy and obesity was different by geographic location with consistent findings observed for both obesity and high waist circumference. While most of the 95% confidence intervals overlap, the association between collective efficacy and obesity appear to be in opposite directions between PR and NY. In PR, there was a positive association—as collective efficacy increased, the prevalence of obesity and high waist circumference increased. On the other hand, the association was negative in NY—as collective efficacy increased, the prevalence of obesity and high waist circumference decreased. This association was similar to the findings described by Cohen et al. (2006), where an increase in collective efficacy was associated with a decrease in BMI among adolescents of different racial/ethnic backgrounds in Los Angeles County. Adolescents who were living in neighborhoods with low collective efficacy were at higher odds of being overweight than those in neighborhoods with average collective efficacy (Cohen et al., 2006). However, similar to Burdette et al. (2006), we found that after adjusting for both individual and neighborhood factors, most of the models showed that the association between neighborhood collective efficacy and obesity and high waist circumference were not statistically significant.

When collective efficacy was examined as a three-level categorical exposure (using cutoffs from the entire sample) we found similar directions of association between the sites, with one difference. In PR, among those living in neighborhoods with medium collective efficacy, the prevalence of obesity and high waist circumference were lower than that of those living in neighborhoods with low collective efficacy. However, the prevalence of obesity and high waist circumference were still higher among those living in neighborhoods with high collective efficacy compared to those in neighborhoods with low collective efficacy.

When collective efficacy was categorized using site-specific cutoffs, we found that the prevalence of obesity was higher among those in both medium and high collective efficacy neighborhoods than in low collective efficacy neighborhoods in PR. The difference in association in PR observed in model 4 and model 5 was likely due to how the distributions of collective efficacy in PR and NY were different, where the distribution was shifted towards the lower end in NY. Overall, the associations were in opposite directions when collective efficacy was continuous and categorized using site-specific cutoffs. There are various potential pathways through which collective efficacy influences obesity prevalence, resulting in the differential associations by site.

Cultural and Social Norms and Obesity

Collective efficacy influences the way people interact with each other and may also impact the way people reinforce social norms around health behaviors and body types. In PR, the positive association between neighborhood collective efficacy and prevalence of obesity may be due to the mechanism that obesity can spread through social ties. It has been observed that obesity tends to occur in social clusters (Christakis & Fowler 2007). In social network analysis, individuals with close tie or relation to another person who is obese have an increased chance of becoming overweight or obese themselves (Christakis & Fowler 2007). However, it is not well understood how obesity spreads in social networks (Hruschka et al., 2011).

Hruschka et al. (2011) found strong association between individuals' BMI and individuals' norm of body size. At the group level, the network's mean BMI was also strongly associated with the network's average norm of body size. Nevertheless, the average norm of the network to which an individual belongs to is only moderately correlated to the individual's norm. The individuals' norms on body size only explained some of the effect of the network's average BMI on individuals' BMI. There is limited evidence supporting that social norms around body standards is the way through which obesity spreads through social networks, resulting in social clusters of obesity (Hruschka et al., 2011). This suggests that other types of social norms such as shared social activities, common health behaviors, social eating and norms around physical activity may be important to how obesity spreads in social networks.

Previously, Ho et al. (2012) reported that 55% of the Puerto Rican population surveyed in BRFSS indicated that they did not participate in physical activity in the past month. In PR, as collective efficacy increases, it is possible that others' health behaviors influence individuals' health behaviors. If the majority of an individual's social ties are not physically active, then the individual might be less likely to be physically active. Additionally, Carroll-Scott et al. (2013)

found that poor dietary habits were associated with more neighborhood social ties. A potential explanation for the positive association between neighborhood collective efficacy and prevalence of obesity in PR is that when individuals' have increased social ties and act in unity with others, the norms around dietary patterns and physical activity may be reinforced. Cohen et al. (2006) hypothesized that among adolescents in Los Angeles County, a higher level of collective efficacy may mean that deviation from the norm is more difficult and that being overweight may be more socially supported.

Socioeconomic Inequities

While the South Bronx and Puerto Rico both have high unemployment and poverty rates, the context and relative socioeconomic positions differ. In 2015, NY ranked number one among all states for the highest income inequality (Sommeiller & Price 2018). The top 1% had an average income that was 44 times the average income of the bottom 99%. This ratio of income inequality was above the nation's average of 26.3 to 1, comparing average income of top 1% and bottom 99% (Sommeiller & Price 2018). The Puerto Rican population in the South Bronx may experience a greater effect of socioeconomic and structural inequity in the city itself, where there is a major concentration of wealth, compared to the Puerto Rican population in PR.

If people are constantly exposed to structural inequity, the accumulation of stress can lead to increases in cortisol excretion and the wear and tear of the body over time, which are both associated with excess weight gain and obesity (Cohen et al., 2006). Thus, as neighborhood collective efficacy increases, people are able to come together and help each other. The greater level of social support and social cohesion may counter the stress from socioeconomic inequities, and a higher level of social orders may help sustain a preferable and healthier environment. Thus, in NY, as collective efficacy increases, we observed a decrease in the prevalence of obesity. While our study sample is relatively young, it is possible that there are windows in the developmental stages where individuals are more vulnerable to the effects of stress (Arevalo et al., 2014).

Collective Efficacy and Built Environment

Cohen et al. (2008) argued that since the social and built environment are intertwined, the built environment may play a critical role in laying the foundation for neighborhood collective efficacy. The neighborhood may be designed in a way that promotes social interaction and encourages people to gather in open spaces (Cohen et al., 2008). In our study, we observed neighborhood collective efficacy to have negative correlations with neighborhood hazards, and positive correlations with neighborhood safety. This suggests that in neighborhoods where people reported having higher degrees of collective efficacy, there may be less excessive noise, trash and traffic in the streets, and people in general feel safer about the neighborhood. It is possible that the built environment moderates the level of neighborhood collective efficacy. Parks and neighborhood collective efficacy are associated at the census-tract level and may represent the community's asset (Cohen et al., 2008). Parks are shared spaces that allow residents to meet and interact with one another. If the neighborhood lacked common spaces, or parks were poorly maintained, then this decreases the opportunity for neighbors to engage with each other (Cohen et al., 2008). Furthermore, an increase in the number of parks and exercise facilities have been associated with increased odds of frequent physical activity and decreased odds of being overweight (Gordon-Larsen et al., 2006). However, many of the studies that looked at neighborhood environment and physical activity were conducted in mainland US, and the findings may not apply to PR.

Given that the socioeconomic contexts in PR and NY are different, the built environment is likely to vary as well, contributing to the divergent association between collective efficacy and obesity at the two sites. In PR, as collective efficacy increases, parks and open spaces may facilitate increased social engagement, but people are more likely to participate in sedentary activities together. Whereas in NY, as collective efficacy increases, the neighborhood may have more resources and power to build a healthier environment.

Strengths and Limitations

Our study was the first to look at how association between neighborhood collective efficacy and prevalence of obesity and high waist circumference could differ by geographic locations. Particularly, we focused on the Puerto Rican population, which has the highest prevalence of obesity among all Hispanic/Latino groups. Most studies on neighborhood collective efficacy and obesity have examined adults and children. Our study fills in the gap by looking at young adults who have some independence but are still mostly reliant on their parents/caregivers. This means that while they are able to make some choices for themselves, choices of where they live and what neighborhood they live in are limited to where their family is.

There are several limitations to this study. First, the nature of our study design and the usage of cross-sectional data prevent us from making causal inferences. The literature on social environment and health has largely been descriptive. Longitudinal data is necessary to understand the mechanisms and the impact of the social environment on health over the life course. Since there were differences between those who were excluded for missing data and those who were included in the analysis, it would be important to address missing data with multiple imputation or inverse probability of treatment weighting (IPTW) in future analyses. Additionally, we only included SES variables measured at the individual level. To better understand why we observed associations in the opposite directions, it would be beneficial to include SES variables measured at the Census-tract level or higher. Furthermore, measures of SES that capture the socioeconomic inequities may be more meaningful than absolute SES measures. Thirdly, it is possible that acculturation plays a role among the NY cohort and influences the pathways between collective efficacy and obesity. In the analysis, we did not adjust for acculturation among the NY cohort. Although the participants of BYS were first identified at ages as young as five in their respective sites and followed through accordingly at their sites, this is a population that is highly mobile. It is highly likely that the NY cohort is exposed to social stressors and discrimination related to being racial/ethnic minorities, which may have an effect on obesity development. Lastly, our study did not account for dietary patterns, which is likely to differ between populations in PR and NY.

CONCLUSIONS

The findings of our study suggest that the neighborhood social environment is important to obesity prevention. Specific aspects of the neighborhood may be more relevant than others in preventing obesity depending on the location and the underlying mechanisms may be site dependent. Collective efficacy can be involved in various pathways, affecting the behavioral, social and physiological factors related to obesity. There is a need for longitudinal data to understand the effects of neighborhood social environment on obesity across the life course, as there may be windows in the developmental stages that are more sensitive to specific neighborhood exposures. When designing obesity prevention interventions, we should focus beyond individuals' dietary and physical activity behaviors and consider how the built and social neighborhood environment can interact and influence health behaviors. Furthermore, the relation between the residents and the neighborhood environment is dynamic and can affect one another. Further studies are warranted to better understand the mechanisms of how various aspects of the neighborhood social environment affect obesity, which will be critical to informing the design of obesity prevention interventions.

REFERENCES

Albrecht, S. S., & Gordon-Larsen, P. (2013). Ethnic Differences in Body Mass Index Trajectories from Adolescence to Adulthood: A Focus on Hispanic and Asian Subgroups in the United States. *PLoS ONE*, *8*(9), e72983.

Allison, M. A., Budoff, M. J., Wong, N. D., Blumenthal, R. S., Schreiner, P. J., & Criqui, M. H. (2008). Prevalence of and Risk Factors for Subclinical Cardiovascular Disease in Selected US Hispanic Ethnic Groups: The Multi-Ethnic Study of Atherosclerosis. *American Journal of Epidemiology*, *167*(8), 962–969.

Aneshensel, C. S., & Sucoff, C. A. (1996). The Neighborhood Context of Adolescent Mental Health. *Journal of Health and Social Behavior*, *37*(4), 293.

Arévalo, S. P., Tucker, K. L., & Falcón, L. M. (2014). Life events trajectories, allostatic load, and the moderating role of age at arrival from Puerto Rico to the US mainland. *Social Science & Medicine*, *120*, 301–310.

Benson, C., & Bishaw, A. (2017). *American Community Survey Briefs*. 17.

Bird, H. R., Canino, G. J., Davies, M., Duarte, C. S., Febo, V., Ramirez, R., Hoven, C., Wicks, J., Musa, G., & Loeber, R. (2006). A Study of Disruptive Behavior Disorders in Puerto Rican Youth: I. Background, Design, and Survey Methods. *Journal of the American Academy of Child & Adolescent Psychiatry*, *45*(9), 1042–1053.

Burdette, H. L., Wadden, T. A., & Whitaker, R. C. (2006). Neighborhood Safety, Collective Efficacy, and Obesity in Women with Young Children*. *Obesity*, *14*(3), 518–525.

Carroll-Scott, A., Gilstad-Hayden, K., Rosenthal, L., Peters, S. M., McCaslin, C., Joyce, R., & Ickovics, J. R. (2013). Disentangling neighborhood contextual associations with child body mass index, diet, and physical activity: The role of built, socioeconomic, and social environments. *Social Science & Medicine*, *95*, 106–114.

CDC. (2020, January 28). *Assessing Your Weight*. Centers for Disease Control and Prevention. https://www.cdc.gov/healthyweight/assessing/index.html

Cerin, E., Saelens, B. E., Sallis, J. F., & Frank, L. D. (2006). Neighborhood Environment Walkability Scale: Validity and Development of a Short Form. *Medicine & Science in Sports & Exercise*, *38*(9), 1682–1691.

Christakis, N. A., & Fowler, J. H. (2007). The Spread of Obesity in a Large Social Network over 32 Years. *N Engl j Med*, 10.

Cohen, D. A., Farley, T. A., & Mason, K. (2003). Why is poverty unhealthy? Social and physical mediators. *Social Science & Medicine*, *57*(9), 1631–1641.

Cohen, D. A., Finch, B. K., Bower, A., & Sastry, N. (2006). Collective efficacy and obesity: The potential influence of social factors on health. *Social Science & Medicine*, *62*(3), 769–778.

Cohen, D. A., Inagami, S., & Finch, B. (2008). The built environment and collective efficacy. *Health & Place*, *14*(2), 198–208.

Dankwa-Mullan, I., & Pérez-Stable, E. J. (2016). Addressing Health Disparities Is a Place-Based Issue. *American Journal of Public Health*, *106*(4), 637–639.

Daviglus, M. L., Talavera, G. A., Avilés-Santa, M. L., Allison, M., Cai, J., Criqui, M. H., Gellman, M., Giachello, A. L., Gouskova, N., Kaplan, R. C., LaVange, L., Penedo, F., Perreira, K., Pirzada, A., Schneiderman, N., Wassertheil-Smoller, S., Sorlie, P. D., & Stamler, J. (2012). Prevalence of Major Cardiovascular Risk Factors and Cardiovascular Diseases Among Hispanic/Latino Individuals of Diverse Backgrounds in the United States. *JAMA*, *308*(17), 1775.

Diez Roux, A. V. (2001). Investigating Neighborhood and Area Effects on Health. *American Journal of Public Health*, *91*(11), 1783–1789.

Duarte, C. S., Canino, G. J., Alegria, M., Ramos-Olazagasti, M. A., Vila, D., Miranda, P., Ramjattan, V., Alvarez, K., Musa, G. J., Elkington, K., Wall, M., Lapatin, S., & Bird, H. (2020). Developmental Psychopathology and Ethnicity I: The Young Adulthood Assessment of the Boricua Youth Study. *Journal of the American Academy of Child & Adolescent Psychiatry*, S089085672030160X.

Ennis, S. R., Ríos-Vargas, M., & Albert, N. G. (2011). The Hispanic Population: 2010. *United States Census Bureau*, 16.

Evans, G. W., & Kantrowitz, E. (2002). Socioeconomic Status and Health: The Potential Role of Environmental Risk Exposure. *Annual Review of Public Health*, *23*(1), 303–331.

Ewing, R., Brownson, R., & Berrigan, D. (2006). Relationship Between Urban Sprawl and Weight of United States Youth. *American Journal of Preventive Medicine*, *31*(6), 464–474.

Flegal, K. M., Ezzati, T. M., Harris, M. I., Haynes, M. G., Juarez, R. Z., Knowler, W. C., Perez Stable, E. J., & Stern, M. P. (1991). Prevalence of Diabetes in Mexican Americans, Cubans, and Puerto Ricans From the Hispanic Health and Nutrition Examination Survey, 1982-1984. *Diabetes Care*, *14*(7), 628–638.

Frank, L. D., Andresen, M. A., & Schmid, T. L. (2004). Obesity relationships with community design, physical activity, and time spent in cars. *American Journal of Preventive Medicine*, *27*(2), 87–96.

Gordon-Larsen, P., Nelson, M. C., Page, P., & Popkin, B. M. (2006). Inequality in the Built Environment Underlies Key Health Disparities in Physical Activity and Obesity. *PEDIATRICS, 117(2*), 417–424.

Ho, G. Y. F., Qian, H., Kim, M. Y., Melnik, T. A., Tucker, K. L., Jimenez-Velazquez, I. Z., Kaplan, R. C., Lee-Rey, E. T., Stein, D. T., Rivera, W., & Rohan, T. E. (2006). Health disparities between island and mainland Puerto Ricans. *Rev Panam Salud Publica*, *19*(5), 331–339.

Horowitz, C. R., Colson, K. A., Hebert, P. L., & Lancaster, K. (2004). Barriers to Buying Healthy Foods for People With Diabetes: Evidence of Environmental Disparities. *American Journal of Public Health*, *94*(9), 1549–1554.

Hruschka, D. J., Brewis, A. A., Wutich, A., & Morin, B. (2011). Shared Norms and Their Explanation for the Social Clustering of Obesity. *American Journal of Public Health*, *101*(S1), S295–S300.

Isasi, C. R., Ayala, G. X., Sotres-Alvarez, D., Madanat, H., Penedo, F., Loria, C. M., Elder, J. P., Daviglus, M. L., Barnhart, J., Siega-Riz, A. M., Van Horn, L., & Schneiderman, N. (2015). Is Acculturation Related to Obesity in Hispanic/Latino Adults? Results from the Hispanic Community Health Study/Study of Latinos. *Journal of Obesity*, *2015*, 1–8.

Kim, D., Subramanian, S. V., Gortmaker, S. L., & Kawachi, I. (2006). US state- and county-level social capital in relation to obesity and physical inactivity: A multilevel, multivariable analysis. *Social Science & Medicine*, *63*(4), 1045–1059.

Kim, Y., Landgraf, A., & Colabianchi, N. (2020). Living in High-SES Neighborhoods Is Protective against Obesity among Higher-Income Children but Not Low-Income Children: Results from the Healthy Communities Study. *Journal of Urban Health*, *97*(2), 175–190.

Kimbro, R. T., Brooks-Gunn, J., & McLanahan, S. (2011). Young children in urban areas: Links among neighborhood characteristics, weight status, outdoor play, and television watching. *Social Science & Medicine*, *72*(5), 668–676.

Krieger, N., Chen, J. T., Waterman, P. D., Soobader, M.-J., Subramanian, S. V., & Carson, R. (2002). Geocoding and Monitoring of US Socioeconomic Inequalities in Mortality and Cancer Incidence: Does the Choice of Area-based Measure and Geographic Level Matter?: The Public Health Disparities Geocoding Project. *American Journal of Epidemiology*, *156*(5), 471–482.

Lochner, K. A., Kawachi, I., Brennan, R. T., & Buka, S. L. (2003). Social capital and neighborhood mortality rates in Chicago. *Social Science & Medicine*, *56*(8), 1797–1805.

Manjunath, L., Hu, J., Palaniappan, L., & Rodriguez, F. (2019). Years of Potential Life Lost from Cardiovascular Disease Among Hispanics. *Ethnicity & Disease*, *29*(3), 477–484.

Molnar, B. E., Gortmaker, S. L., Bull, F. C., & Buka, S. L. (2004). Unsafe to Play? Neighborhood Disorder and Lack of Safety Predict Reduced Physical Activity among Urban Children and Adolescents. *American Journal of Health Promotion*, *18*(5), 378–386.

Office of the State Deputy Comptroller for the City of New York. (2018). *An Economic Snapshot of the Bronx*. 8.

Pearl, M., Braveman, P., & Abrams, B. (2001). The Relationship of Neighborhood Socioeconomic Characteristics to Birthweight Among 5 Ethnic Groups in California. *American Journal of Public Health*, *91*(11), 1808–1814.

Rajaratnam, J. K., Burke, J. G., & O'Campo, P. (2006). Maternal and child health and neighborhood context: The selection and construction of area-level variables. *Health & Place*, *12*(4), 547–556.

Roman, J. (2015). The Puerto Rico Healthcare Crisis. *Annals of the American Thoracic Society*, *12*(12), 1760–1763.

Romero, A. J., Robinson, T. N., Kraemer, H. C., Erickson, S. J., Haydel, K. F., Mendoza, F., & Killen, J. D. (2001). Are Perceived Neighborhood Hazards a Barrier to Physical Activity in Children? *Archives of Pediatrics & Adolescent Medicine*, *155*(10), 1143.

Sampson, R. J. (1997). Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy. *Science*, *277*(5328), 918–924.

Sampson, Robert J., Morenoff, J. D., & Earls, F. (1999). Beyond Social Capital: Spatial Dynamics of Collective Efficacy for Children. *American Sociological Review*, *64*(5), 633.

Sommeiller, E., & Price, M. (2018). *The new gilded age: Income inequality in the U.S. by state, metropolitan area and county*. Economic Policy Institute.

Stanford University. (n.d.). *Collective Efficacy Scale | SPARQTools*. SPARQTools. Retrieved December 1, 2019, from http://sparqtools.org/mobility-measure/collective-efficacy-scale/

Subramanian, S. V., Kim, D. J., & Kawachi, I. (2002). Social Trust and Self-Rated Health in US Communities: A Multilevel Analysis. *Journal of Urban Health: Bulletin of the New York Academy of Medicine, 79*(90001), 21S – 34.

Suglia, S. F., Shelton, R. C., Hsiao, A., Wang, Y. C., Rundle, A., & Link, B. G. (2016). Why the Neighborhood Social Environment Is Critical in Obesity Prevention. *Journal of Urban Health*, *93*(1), 206–212.

Yen, I. H., & Syme, S. L. (1999). The Social Environment and Health: A Discussion of the Epidemiologic Literature. *Annual Review of Public Health*, *20*(1), 287–308.

Table 1. Demographic, neighborhood characteristics and weight status by site

	Overall (N=655)		San Juan, Puerto Rico (N=351)		South Bronx, New York (N=304)		p value
Age, years (Mean, SD)	22.50	1.9	22.43	1.85	22.66	1.94	0.1242
Sex (N,%)							0.5625
Male	326	49.8	171	48.7	155	51.0	
Female	329	50.2	180	51.3	149	49.0	
Maternal Education Level (N, %)							<.0001
Less than high school	236	36.0	89	25.4*	147	48.4*	
High school/GED	262	40.0	137	39.0*	125	41.1*	
College or more	157	24.0	125	35.6*	32	10.5*	
Current Residency (N, %)							0.1692
Parent/Caretaker's home	446	68.1	238	67.8	208	68.4	
Own home or Friend/Acquaintances' home	180	27.5	102	29.1	78	25.7	
Other Housing Arrangements	29	4.4	11	3.1	18	5.9	
Received Public Assistance (N, %) total	417	63.7	221	63.0	196	64.5	0.6885
Neighborhood Measures (Mean, SD)							
Neighborhood Hazards	18.2	6.3	17.37*	6.44	19.14*	5.98	0.0003
Neighborhood Walkability	42.3	5.7	41.35*	6.01	43.50*	5.14	<.0001
Neighborhood Collective Efficacy	21.1	4.8	22.48*	4.61	19.44*	4.40	<.0001
Neighborhood Safety	1.4	0.6	1.56*	0.56	1.22*	0.66	<.0001
BMI, lb/in2 (Mean, SD)	26.55	7.25	25.22*	6.62	28.08*	7.65	<.0001
BMI (N, %)							<.0001
BMI <30.0	477	72.8	279	79.5*	198	65.1*	
BMI ≥30.0	178	27.2	72	20.5*	106	34.9*	
Waist Circumference, inches (Mean, SD)	36.4	6.7	35.35*	5.99	37.52*	7.27	<.0001
Waist Circumference (N, %)							
>40 in. (Males)	77	23.6	30	17.5*	47	30.3*	0.0067
>35 in. (Females)	171	52.0	81	45.0*	90	60.4*	0.0054

*p value <0.05; independent t-tests were conducted on continuous variables and chi-square tests were conducted on categorical variables to determine the differences in distribution by site

Values are mean (standard deviation) for continuous variables and count (percentage) for categorical variables

Table 2. Pearson correlation coefficients for neighborhood measures by site

	Puerto Rico					New York				
	Hazards	**Walkability**	**Collective Efficacy**	**Safety**	**p values**	**Hazards**	**Walkability**	**Collective Efficacy**	**Safety**	**p values**
Hazards	1.00	-0.47	-0.32	-0.40	<0.05	1.00	-0.34	-0.19	-0.52	<0.05
Walkability	-0.47	1.00	0.25	0.21	<0.05	-0.34	1.00	0.30	0.26	<0.05
Collective Efficacy	-0.32	0.25	1.00	0.36	<0.05	-0.19	0.30	1.00	0.24	<0.05
Safety	-0.40	0.21	0.36	1.00	<0.05	-0.52	0.26	0.24	1.00	<0.05

Table 3. Prevalence ratio and 95% confidence interval for association between neighborhood collective efficacy and obesity by stratified log binomial regression, unadjusted and adjusted for individual factors and neighborhood factors separately

	Puerto Rico		**New York**	
	Model 0: Unadjusted		**Model 0: Unadjusted**	
	Obesity PR (95% CI)	High Waist Circumference PR (95% CI)	Obesity PR (95% CI)	High Waist Circumference PR (95% CI)
Neighborhood Collective Efficacy§	1.02 (0.97,1.07)	1.00 (0.97,1.04)	0.97 (0.94,1.00)	0.97 (0.95,1.00)*
	Model 1 Adjusted for Individual Factors†		**Model 1 Adjusted for Individual Factors†**	
	Obesity PR (95% CI)	High Waist Circumference PR (95% CI)	Obesity PR (95% CI)	High Waist Circumference PR (95% CI)
Neighborhood Collective Efficacy§	1.02 (0.98,1.07)	1.02 (0.98,1.05)	0.97 (0.94,1.00)	0.98 (0.96,1.01)
	Model 2 Adjusted for Neighborhood Factors‡		**Model 2 Adjusted for Neighborhood Factors‡**	
	Obesity PR (95% CI)	High Waist Circumference PR (95% CI)	Obesity PR (95% CI)	High Waist Circumference PR (95% CI)
Neighborhood Collective Efficacy§	1.03 (0.98,1.09)	1.01 (0.97,1.05)	0.97 (0.94,1.00)	0.97 (0.94,1.00)*

**p* value <0.05

§Estimates represent prevalence ratio of obesity with 1 unit increase in neighborhood collective efficacy total score

†Individual factors are age, gender, current residency, maternal education and receipt of public assistance in the last year

‡Neighborhood factors are neighborhood hazards, neighborhood walkability and neighborhood safety

Table 4. Prevalence ratio and 95% confidence interval for association between neighborhood collective efficacy and obesity by stratified log binomial regression and adjusted with all covariates

	Model 3: Puerto Rico†		**Model 3: New York†**	
	Obesity PR (95% CI)	High Waist Circumference PR (95% CI)	Obesity PR (95% CI)	High Waist Circumference PR (95% CI)
Neighborhood Collective Efficacy§	1.04 (0.98,1.09)	1.01 (0.98,1.05)	0.97 (0.94,1.00)	0.97 (0.94,1.00)*
	Model 4: Puerto Rico†		**Model 4: New York†**	
	Obesity PR (95% CI)	High Waist Circumference PR (95% CI)	Obesity PR (95% CI)	High Waist Circumference PR (95% CI)
Neighborhood Collective Efficacy§§				
Low Collective Efficacy	–	–	–	–
Medium Collective Efficacy	0.86 (0.46,1.63)	0.82 (0.54,1.24)	0.80 (0.58,1.11)	0.83 (0.66,1.05)
High Collective Efficacy	1.55 (0.82,2.90)	1.15 (0.74,1.80)	0.64 (0.35,1.15)	0.73 (0.46,1.15)

*p value <0.05

§Estimates represent prevalence ratio of obesity with 1 unit increase in neighborhood collective efficacy total score

§§Estimates represent prevalence ratio of obesity comparing medium and high neighborhood collective efficacy to low neighborhood collective efficacy. Neighborhood Collective Efficacy was categorized using the cutoffs from the overall summed score as low (≤18.0), medium (18.1 – 24.9) and high (≥ 25.0).

†Adjusted for neighborhood hazards, neighborhood walkability, neighborhood safety, age, gender, current residency, maternal education and receipt of public assistance in the last year

Table 5. Prevalence ratio and 95% confidence interval for association between neighborhood collective efficacy and obesity using site-specific tertiles in stratified log binomial regression and adjusted with all covariates

	Model 5: Puerto Rico†		**Model 6: New York†**	
	Obesity PR (95% CI)	High Waist Circumference PR (95% CI)	Obesity PR (95% CI)	High Waist Circumference PR (95% CI)
Neighborhood Collective Efficacy§§				
Low Collective Efficacy	–	–	–	–
Medium Collective Efficacy	1.25 (0.73,2.14)	1.14 (0.80,1.62)	0.89 (0.62,1.27)	0.84 (0.64,1.09)
High Collective Efficacy	1.57 (0.86,2.85)	1.34 (0.86,2.09)	0.68 (0.44,1.04)	0.74 (0.55,0.99)*

*p value <0.05

§§Estimates represent prevalence ratio of obesity comparing medium and high neighborhood collective efficacy to low neighborhood collective efficacy. Neighborhood Collective Efficacy was categorized using site-specific tertiles as low (≤20.0), medium (20.1-26.9) and high (≥27.0) in Puerto Rico and low (≤17.0), medium (17.1-21.9) and high (≥22.0) in New York.

†Adjusted for neighborhood hazards, neighborhood walkability, neighborhood safety, age, gender, current residency, maternal education and receipt of public assistance in the last year

Table 6. Prevalence ratio and 95% confidence interval for association between neighborhood collective efficacy and obesity by stratified log binomial regression and adjusted with PSCAT Index for SES and all covariates

	Puerto Rico		New York	
	Obesity	High Waist Circumference	Obesity	High Waist Circumference
	PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)
Neighborhood Collective Efficacy§	1.03 (0.97,1.09)	1.01 (0.97,1.05)	0.97 (0.94,1.01)	0.97 (0.94,1.00)*

**p* value <0.05

§Estimates represent prevalence ratio of obesity with 1 unit increase in neighborhood collective efficacy total score.