Neighborhoods and Health Behaviors among Low-income Mexican American Children

by

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ABSTRACT

Ecological systems theory argues that multiple nested systems impact child development. This study used a moderated mediation pathway to examine whether presence of a grocery store, number of fast-food restaurants, outdoor play space, and outdoor play safety affected children’s blood pressure and BMI through variation in healthy family habits. Maternal perceived neighborhood social and cultural cohesion was examined as a moderator of the mediated effect. Data was collected from 214 mother–child dyads via biological measurement, maternal-report surveys, and geocoding of children’s neighborhoods using Google Earth. Zero-order correlations showed that higher number of fast-food restaurants in a child’s neighborhood was correlated with less engagement in healthy family habits and lower child BMI z-score. In all models, higher neighborhood social and cultural cohesion was associated with more engagement in healthy family habits. No statistically significant mediated effects or moderation of the mediated effects were found. Future directions may aim to identify which objective neighborhood environment indicators influence child health and what are potential variables mediating the relation.

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Introduction

Low-income Mexican American children face increased risk for developing problematic physical health conditions (e.g., metabolic syndrome, type-2 diabetes) compared to other ethnic groups (Flores et al., 1999; Skelton et al., 2009; Weiss et al., 2004; Trevino et al., 1999). Despite growing public awareness of the associations between nutrition and physical activity on child health, low-income Mexican American children continue to have lower daily fruit and vegetable intake than recommended dietary guidelines, higher than recommended fat servings, higher percent energy from fat and saturated fat, and engage in less physical activity (Trevino et al., 1999). Pervious national surveys show low-income children are twice as likely to experience poor health (e.g., low birth weight, increased heart rate) compared to more affluent groups.

Exposure to a low-income environment and consequential stressors during childhood can influence trajectories of poor health across development (Galobardes et al. 2004). Research indicates that once children develop problematic health conditions, they are often difficult to overturn (Simmonds et al., 2016). Previous research examining children’s health largely focuses on parental behaviors (Oliveria et al.,1992; Wardle, 1995; Contento et al., 1993; Birch & Marlin, 1982), however parental feeding and child physical activity may be better understood by examining a family’s broader environment. A growing body of literature has found preliminary evidence for the value of built environments (e.g., neighborhoods) in predicting children’s physical health (Molnar et al., 2004; Franzini et al., 2009; Singh et al., 2008). The “built environment” is a multidimensional construct that integrates urban design, land use, transportation systems, and patterns of activity within a particular physical environment (Handy et al., 2002).

Ecological systems theory highlights the importance of examining a child's environment to investigate the multiple systems of influence on human development. Bronfenbrenner (1986) describes ecological systems theory as an interactive system in two parts: the dimension of external influences that affect the family across quality and strength, and the degree of explicitness and exclusivity that external influences affect intrafamilial processes. Bronfenbrenner distinguishes a child's environment into different nested levels: the microsystem, mesosystem, exosystem, macrosystem, and chronosystem. The microsystem includes the direct interactions the child has with their surroundings (e.g., family, peers, school, neighborhood, childcare). The mesosystem includes the interactions between different levels of the microsystem and exosystem (e.g., family and school, peers, and neighborhood). The exosystem includes the physical and social structure that the child does not directly interact with, however indirectly experiences through more proximal systems. Variables in the exosystem (e.g., neighborhood) indirectly affect the child through different variables in the child's microsystem (e.g., parent behaviors). The macrosystem includes cultural values, customs, and laws. The chronosystem includes dimensions of time, such as longitudinal developmental changes. Using ecological systems theory framework, Rutter and colleagues (1975) showed support for specific ecological effects predicting health outcomes between different types of neighborhoods. Rutter argues these ecological neighborhood effects happen both directly to the individual child and indirectly through the family. The multilevel consequences of the built environment on health remain unclear, although previous research and theory supports its significance in predicting child health.

Built Environments and Nutrition

According to ecological systems theory, although built environments are at the exosystem level, they can influence children's nutrition through more central systems. Morland and colleagues (2002) show that low-income families are unable to purchase high quality foods (i.e., less processed) both due to their elevated cost and lack of availability. Commercial trends show supermarkets (i.e., largest food retail locations according to North America Industry Classification System) moving away from urban areas with greater poverty and ethnic diversity towards areas of elevated wealth, most notably suburban and white communities. Wealthier neighborhoods have more supermarkets overall, more supermarkets in mostly white areas, more "heart-healthy" foods per supermarket, more gas stations with convenience stores, and less places to consume alcoholic beverages (Morland et al., 2002). These findings demonstrate how exosystems may commonly impact children's microsystem (e.g., family behaviors) by truncating opportunities for nutrition.

Although the demographic composition of supermarket shoppers is representative across ethnic group, groups of lower socioeconomic status report significant distance and a lack of a private transportation as a key barrier to utilizing supermarkets (Ver Ploeg et al., 2012). These findings show that where individuals purchase groceries is more dependent on their resources (e.g., transportation) than on cultural values placed on types of food outlets. The lack of grocery stores may cause families to reply on convenience stores to make most of their purchases, resulting in higher expenses and lower net nutrition values long term. Suppliers and food retailers incentivize customers buying in bulk by lowering price per metric unit as quantities of a product increase (Morland et al., 2002), however given low-income families' lack of funds at any given time and limited access to supermarkets where bulk items are traditionally sold, families are forced to purchase foods at the least efficient margin and spend much more incrementally than their more financially stable counterparts (Collier, 2008).

Additionally, research shows increases in ethnical fast-food advertisements targeting minority families due to younger household compositions and increased number of children compared to non-minority families (Kumyanika, 2008; Grier et al., 2007). This leads to increased media exposure, a problematic result given the disproportionate advertising of energy-dense and highly processed foods during minority-targeted programming (Outley & Taddese, 2006). Henderson & Kelly (2005) found through program content analyses that advertisements shown during African American shows contained significantly more content for fast food and energy-dense foods. These results show additional support for macrosystem variables influencing individual behaviors by manipulating the microsystem. Thus, not only do lower-income families have less access to healthy foods, but they are continuously reinforced by media to purchase more energy-dense and highly processed foods creating an environment conducive to poor health. Conversely, Yancey and colleagues (2009) found that living in an upper-income neighborhood protected against the negative health impacts of increased exposure to outdoor advertising (e.g., fast food, sugary beverages, sedentary entertainment, transportation) across ethnicity. These results stress the importance of understanding how built nutrition environments interact with family behaviors.

Built Environments and Physical Activity

Limited access to outdoor physical activity environments also characterizes disadvantaged neighborhoods (Singh et al., 2008). Limited access to exercise facilities, programs, and poor perceived neighborhood safety all affect a child's opportunity for physical activity (Singh et al., 2010). Built environment correlates of physical activity among children are particularly important given their lack of autonomy in eating behaviors. A review from Ding and colleagues (2011) shows that among adults, literature from public health, transportation, urban planning, and leisure studies demonstrate associations between built environments and physical activity, although few studies have aimed to replicate these effects among children. Results from previous literature show mixed results due in part to heterogeneity of samples, mode of measurement (e.g. objective, perceived), and outcome (e.g., walking, rigorous exercise) of physical activity. Larson and colleagues (2006) demonstrated that children who lived in high-socioeconomic status (SES) census blocks had the greatest odds of having at least one recreational space. In contrast, children in low-SES and high-minority census blocks were the least likely to have at least one recreational space. Results also showed that as number of recreational spaces increased, overweight decreased and odds of engaging in at least five instances of moderate-vigorous physical activity increased within the sample. Qualitative research demonstrates that Hispanic children cite lack of space as a primary barrier to physical activity (Ross & Francis, 2016). Sallis & Glanz (2006) demonstrated the lack of low-cost recreational facilities in a low-SES area to further support the notion that disadvantaged neighborhoods lack the built environment to promote physical activity among children.

Findings showing lower physical activity among children in poorer neighborhoods replicate across multiple studies. The odds of developing obesity or overweight in a low-income environment rises 20-60% compared to those in a mean level environment (Singh et al., 2010). This may be due to land use low in physical activity opportunity or low neighborhood safety (Molnar et al., 2004). A key barrier to physical activity among Mexican American children may be safety of the built environment. The "broken window hypothesis" states that neighborhood safety is directly related to perceptual order, such that high physical disorder (e.g., broken windows, vandalism, vacant homes) indicates that residents are unable to monitor their environment and are thus easily targets for potential crime (Harcourt, 1998). Sampson and Raudenbush (1999) suggest that rather than crime being an indicator of neighborhood disorder (e.g., visible cues indicating a lack of peace, safety, and observance of the law), neighborhood disorder and crime may both be independent consequences of structural characteristics of a neighborhood. Molnar and colleagues (2004) argue that regardless of the cause of neighborhood disorder, disordered neighborhoods may potentially inhibit children from exercising due to the lack of safe sites in the neighborhood and lack of safety when traveling to recreational sites.

Neighborhood Cohesion

As stated previously, ecological developmental perspectives consider individuals nested within a family, families nested within a neighborhood, and each of these levels jointly influencing each other (Bronfenbrenner, U., 1994) Previous research suggests that parenting processes mediate the relation between neighborhood environment and youth development (Garcia Coll et al., 1996). Therefore, caregivers' perceptions of their neighborhood's social and cultural cohesion may be an important moderator between the neighborhood and family processes.

Neighborhood social and cultural cohesion is defined by shared mutual values, goals, cultural traditions, and trust among neighbors. Previous research has proposed perceived neighborhood cohesion as a potential microsystem variable to improve health behaviors. Neighborhood cohesion offers a social and cultural resource to families in buffering the negative effects of neighborhood impoverishment on health among adults (Van der Linden et al., 2003) and neighborhood socioeconomic adversity (Robinette et al. 2013). Robinette and colleagues (2013) demonstrated that among a U.S. national sample of adults, higher perceived neighborhood cohesion predicts fewer self-reported daily stressors, higher positive affect, lower negative affect, and fewer physical health symptoms. Rios and colleagues (2012) show that among Hispanic adults, better neighborhood social cohesion significantly predicts better physical health. The influence neighborhood cohesion has on child nutrition and physical activity remains unclear.

Kawachi and Berkman (2000) have suggested three pathways by which neighborhood social cohesion may influence health outcomes: 1) by directly influencing health-related behaviors, 2) by influencing access to health-related services, and 3) by influencing psychosocial processes. First, direct influence of social cohesion on health-related behaviors may operate through increased diffusion rate of health information (Rodgers, 1983) and increased adoption of healthy norms (e.g., physical activity, nutrition). Rodgers' (1983) theory of diffusion of innovation suggests that communities with higher trust in each other diffuse innovative behaviors (e.g., healthier eating practices) more rapidly. Second, higher social cohesion may improve health by increasing availability of local health services. Research in criminology suggests that more socially cohesive neighborhoods more collectively and successfully advocate to maintain local budgets (Sampson et al., 1997). Kawachi and Berkman (2000) argue that these organizational processes may provide the social infrastructure to ensure local access to health services such as transportation, community health clinics, and recreational facilities. Lastly, Wilkinson (1996) argues that social cohesion improves psychological processes by providing individuals emotional support and encouragement for increased self-esteem and mutual respect. Research demonstrates that socially isolated individuals in high social cohesion communities experience more positive health outcomes than those in less cohesive communities (Seeman at al., 1993; Schoenbach et al. 1986; Reed et al., 1983).

The Current Study

The current study aims to examine the extent to which child nutrition and physical activity mediate relations between neighborhood environment and physical health. Additionally, this study will examine neighborhood social and cultural cohesion as a moderator of the relation between neighborhood environment and nutrition and physical activity. Research demonstrates metabolic syndrome rates as high as 50% in certain samples of obese children, which demonstrates obesity's importance as a risk factor, although not as an exclusive predictor of child health (Weiss at al., 2004). Research shows that by the age of ten, children are developmentally appropriate for diabetic diagnosis (American Diabetes Association, 2000), suggesting that gathering information prior to this age is essential for preventative risk assessment. Systolic (SYS) and diastolic (DIA) blood pressure are two important childhood vital signs as they are associated with physical fitness (Hoffman et al., 1987), sleep (Enright et al., 2003), cardiovascular morbidity and mortality among adult populations (Stamler et al., 1993). Given the growing evidence that obesity may be a narrow predictor of physical health, this study aims to take a holistic perspective on physical health outcomes (Oliver, 2006; Sabin et al., 2012) by including multiple indicators of child health: systolic blood pressure, diastolic blood pressure, and BMI.

Measuring Built Environment. Brownson and colleagues (2009) detail over 20 different audit validated protocols within the last ten years that tap into objective measures of the built environment. A number of these protocols are notably compatible with Google Earth, a mechanism that in recent years has become a validated tool to collect data on built environments (Clarke et al., 2010). Google Earth shows adequate convergent validity when compared to in-person observational audit data collection. Clarke and colleagues (2010) demonstrated that Google Earth could reliably measure recreational facilities, local food environment, and general land use. Research also demonstrates that objective (rather than perceived) measures of neighborhood environmental attributes show the most consistent correlations with physical activity (Ding et al., 2011). Systemic social observation techniques allow researchers to gather objective data on participants' built environment without the bias of self-report measures. Google Earth also notably offers an unobtrusive and low-cost alternative to traditional systemic social observation that may potentially aid healthcare advocates and urban planners alike in encouraging stakeholders to improve built environments in low-funded areas to increase childhood opportunity. This study will utilize Google Earth integrating aspects of protocols validated by Hoehner and colleagues (2005) and Pasco & White (2020).

The objectives and hypotheses of the current study are as follows:

Aim 1: Examine neighborhood environment as a predictor of child physical health.

Hypotheses 1: a) Presence of a grocery store, b) less fast-food restaurants, c) more outdoor play spaces, and d) more outdoor play safety indicators will be related to lower child systolic blood pressure, diastolic blood pressure, and BMI (Figure 1).

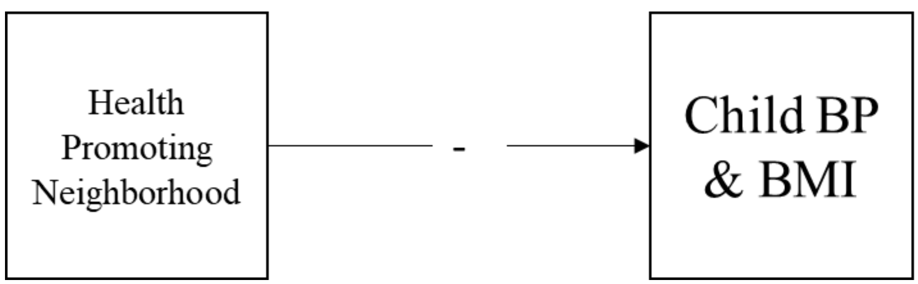

Figure 1. Conceptual figure for hypothesis 1.

Aim 2: Examine family health habits as a potential mediator of the relation between neighborhood environment and child physical health.

Hypothesis 2: a) Presence of a grocery store, b) less fast-food restaurants, c) more outdoor play spaces, and d) more outdoor play safety indicators will be related to more engagement in healthy family habits (a paths). More engagement in healthy family habits will be related to lower child systolic blood pressure, diastolic blood pressure, and BMI (b paths). It was hypothesized that more engagement of healthy family habits would continue to be related to lower systolic blood pressure, diastolic blood pressure, and BMI even after controlling for the relationship of neighborhood environment on health family habits (c' paths; Figure 2).

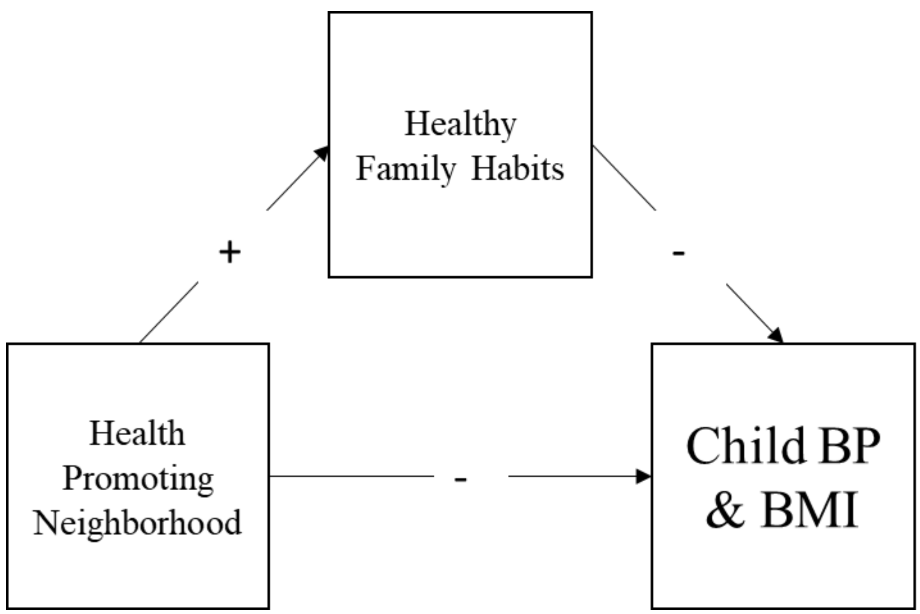

Figure 2. Conceptual figure for hypothesis 2.

Aim 3: Examine neighborhood social and cultural cohesion as a moderator on the relation between neighborhood environment and healthy family habits (Figure 3).

Hypothesis 3: The interaction between a more health promoting neighborhood and high neighborhood cultural cohesion will be related to more engagement in healthy family habits, compared to the interaction between a more health promoting neighborhood and mean level or low neighborhood cultural cohesion.

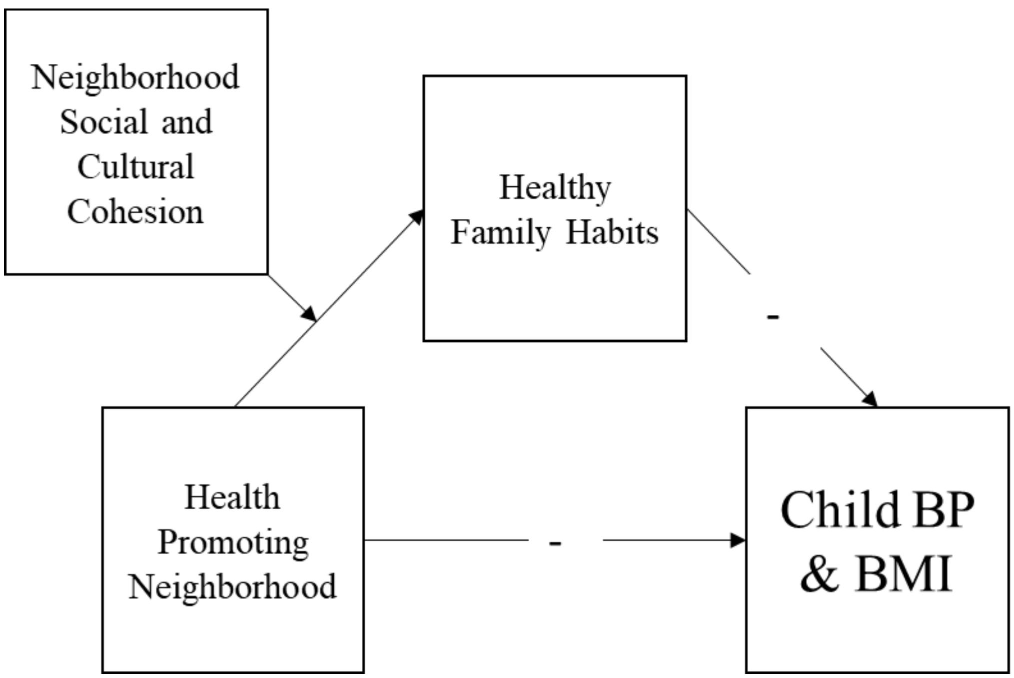

Figure 3. Conceptual figure for hypothesis 3.

Method

Parent Study: Las Madres Nuevas

The current study builds off a longitudinal ongoing NIMH and NICHD-funded study examining very low-income Mexican American (MA) mothers and their offspring

(Las Madres Nuevas; LMN). Three hundred and forty-seven low-income MA pregnant women were recruited between 2010-2012 from prenatal clinics operated by Maricopa Integrated Health System (MIHS). Eligibility criteria included: 1) age 18 or older, 2) Spanish or English fluency, 3) self-identified as Mexican/Mexican American, 4) singleton delivery, and 5) low-income (i.e., family income below $25,000). LMN collected/collects data at multiple time points from the prenatal period through child age 9. The parent study includes biological, anthropometric, parent-report, child-report, medical, and observational measures. The parent study aims to answer questions regarding health disparities among very low-income Mexican American children. Both child and mothers have been assessed repeatedly every year to 1 ½ years after the infancy stage. For each lab visit, mothers are compensated financially for their time. The parent study has IRB approval and for each lab visit, parental consent and child assent to participate is obtained. The current study uses a subset of measures and data from the larger parent study.

Participants

The current study includes 214 Mexican American mother–child dyads. Data was collected when child was age 4.5 years (assigned female at birth: 53.7%). At the prenatal timepoint, 42.8% of mothers were married and lived together with partner, 34.5% lived with a partner but were not legally married, 9.6% never married and were not with partner, 10.5% were separated or divorced, and 2.6% were married but did not live with partner. Prenatally, mothers report very low-education (59% did not complete high school) and low income (median $10,000-$15,000, supporting on average 5 people: 3

children [range 1-11] and 2-3 adults). Most women were born in Mexico (89%) and speak Spanish (84%). At the prenatal time point, 45% of the families moved, 9% had been homeless at some point, 10% had a partner in jail, 16% had a partner with a serious drinking or drug problem, 33% had many bills they could not pay, 19% witnessed violence in their community, 33% reported that her partner lost his job, 16% feared deportation, and 23% experienced the death of someone close. Prenatally, food insecurity was prevalent: 46% classified as "food insecure" on the USDA Household Food Security Scale (Bickel et al., 2000). Table 1 shows sample demographics for the 214 participants examined at the 4.5-year time point.

Audit of Built Environment

Audits of neighborhood environments were conducted using Google Earth. First, a graduate student created a 400 meter buffer region around every child's address (N = 214) and enumerated every street (n = 2,361) within the buffers (M = 11.05; SD = 3.4). Next, undergraduate and post-graduate research staff (n = 10) were trained to conduct audits of built environment. Training of coders included downloading the Google Earth application, meeting in small groups to practice completing audits, and comparing discrepancies between coders during a 2- to 4-week training phase. After training phase, teams of two coders separately "walked" the streets within assigned neighborhood 400m buffer regions and counted grocery stores, fast-food restaurants, outdoor play spaces (i.e., parks, playgrounds, sports fields), and outdoor play safety indicators (i.e., streetlights, sidewalks, traffic signs, speed bumps). Fliess' kappa was tested on a random sample of 25% of the addresses to determine inter-rater reliability. Given the low to moderate reliability established between the random coders sampled (.54), all discrepancies between coding iterations were checked and reconciled by a trained graduate student. The graduate student compared completed audits by identifying discrepancies at the street level (e.g., Coder 1 counted one fast-food restaurant and Coder 2 counted two fast-food restaurants) then "walking" specific streets to determine which coder counted accurately. Discrepancies where reconciled variable by variable across all built environment indicators to optimize accuracy of the dataset. The resulting data was used for this study's analyses.

Measures

Presence of Grocery Store. Presence of a "grocery store" was determined if a neighborhood buffer contained any food store, including organic markets, regular grocery stores, box stores (e.g., Walmart), or Latinx stores (e.g., carniceria). "Corner" or convenience stores were not considered grocery stores in the neighborhood audit. Presence of a grocery store was scored as a binary variable (0 = absence of grocery store, 1 = presence of at least one grocery store).

Fast-Food Restaurants. Restaurants were counted as "fast-food" if they were large-chain or small-chain restaurants with limited food service. Limited-service locations that served exclusively Latinx cuisine (e.g., taquerias), sold primarily baked goods (e.g., panaderia, pasteleria), or sold primarily alcohol (e.g., bars, clubs) were not included in the final fast food count. Full-service restaurants were also excluded from final count. Coders relied on name recognition (Morland et al., 2002), online menus, and Google Street View to determine designation for food outlets.

Outdoor Play Space. Outdoor play spaces included parks, playgrounds, and sports fields, trails, and pools that appeared to be accessible to the public. Indicators of parks, playgrounds, sports fields, trails, and pools were counted and then summed to create a continuous outdoor play space variable. Private outdoor play spaces (e.g., basketball hoop in front of a house, fenced school field) were excluded from final variable count. Higher numbers indicated more outdoor play space.

Outdoor Play Safety. Play safety was first scored as a binary variable, with a "1" signifying the presence of streetlights, a sidewalk, at least one traffic sign (e.g., yield), at least one stop sign, and at least one speed bump on a specific street street and "0" signifying the absence of the indicators. Play safety variables were then added together across streets, then divided by the total number of streets in the specific buffer region to adjust for differences in the number of streets present in each neighborhood. Higher numbers indicated more outdoor play safety.

Healthy Family Habits. The Family Nutrition and Physical Activity Checklist (FNPA; Ihmels et al., 2009) is a 20-item measure developed by the American Dietetics Association. Factor analyses in the scale's parent-validation paper revealed the presence of a single factor and the unidimensional structure was supported by a correlation analysis (Ihmels et al., 2009). The FNPA is a mother-reported measure that assesses family environmental and behavioral factors that may predispose a child to becoming overweight. Questions (e.g., "our family provides opportunities for physical activity", "our family eats fast food") are answered on a 4-point Likert scale from "almost never" to "almost always." Higher total scores indicate more favorable family environment for nutrition and physical activity. Past research shows FNPA scores followed demographic patterns with low-income families reporting lower scores than moderate or high-income families (Ihmels et al., 2009). The FNPA initially showed acceptable internal consistency in the current study (alpha = .69). After closer inspection of items, it was determined that reverse scored items introduced measurement error within the current sample. Previous research suggests that among some samples (e.g., lower education, higher age) reverse coded items decrease overall validity of a measure (Rodebaugh et al., 2011). Recoded items were deleted for a final total of 14 items (alpha = .75).

Neighborhood Social and Cultural Cohesion. Neighborhood Cultural/Social Cohesion (NCC) Scale (questions used from both Sampson et al., 1997 and Nair et al., 2013) is a mother-reported 12-item measure assessing maternal perception of neighbors' shared mutual values, goals, and trust. Questions (e.g., "people around here are willing to help their neighbors", "people in this neighborhood appreciate Mexican culture and people") are answered on a 5-point Likert scale from "none of them" to "all of them." Higher total scores indicate higher perceived neighborhood cohesion The NCC shows good internal consistency in the current study (alpha = .91).

Child Physical Health. Systolic blood pressure, diastolic blood pressure, height, and weight were collected by trained interviewers using standard electronic medical instruments. BMI-for-age percentile z-scores (BMI) were calculated using a program (available at http://www.who.int/childgrowth/software/en/) provided by the World Health Organization (WHO), which uses 2006 tables and data. The program flags and sets to missing any BMI percentile z scores considered “biologically implausible,” based on a z-score <-5.0 or >5.0.

Data Analytic Plan

Preliminary Analyses. Preliminary data analyses were completed in *SPSS 26* (IBM Corp, 2019). There was one missing case for outdoor play space data and 9% to 20% of missing data on outcome variables. Missing data was handled using maximum likelihood estimation. NCC, outdoor play space, and outdoor play safety variables were mean centered to reduce multicollinearity and increase interpretability of results (Cohen et al., 2003). Fast-food restaurants and presence of a grocery store (binary variable) were not mean centered and kept as raw count variables. Prior to conducting primary analyses, distributions for the neighborhood audit, NCC, FNPA, and child physical health were examined for outliers to meet normality assumptions including skewness and kurtosis (Table 2).

Primary Analyses. Primary analyses for the moderation of the mediated effect were completed in *MPlus* (Muthen & Muthen, 2009). Twelve moderated single mediator models were estimated within a multivariate regression framework. To test hypothesis 1 of a direct effect of built environment to child health, outcomes of systolic blood pressure, diastolic blood pressure, and BMI were regressed on predictor variables. Presence of a grocery store (Models 1-3), number of fast-food restaurants (Models 4-6), outdoor play space indicators (Models 7-9), and outdoor play safety indicators (Models 10-12) were entered as the predictor variable in the respective models.

To test hypothesis 2 of the indirect effect of built environment to child health through family habits, models 1-12 included FNPA (M) in the respective regression equations as a mediator variable. To test hypothesis 3 of the conditional indirect effect, NCC (W) was entered as a moderator variable along with relevant interaction terms to all regression equations. Specifically, for models 1-3, one interaction term (i.e., grocery store presence x NCC) was added as a predictor into the regression equation. For Models 4-6, one interaction term (i.e., fast food restaurants x NCC) was added as a predictor. For Models 7-9, one interaction term (play space x NCC) was added as a predictor. Models 10-12, one interaction term (play safety x NCC) was added as a predictor. Predictors in models with number of fast-food restaurants as a count variable (Models 4-6) were not allowed to correlate. All predictors in the remaining models were all allowed to correlate.

Models 1-12: $Y = b_0 + b_1M + c'X$

$M = a_0 + a_1X + a_2W + a_3XW$

To test hypotheses 1-3, estimates and significance for the individual paths, the mediated effects, and the moderation of the mediated effects at values -1SD, mean, and +1SD of NCC were computed.

Results

Preliminary Analyses

Bivariate Correlations. Table 2 includes the means, standard deviations, skewness, and kurtosis values for study variables. Table 3 includes zero-order bivariate correlations between study variables. Presence of a grocery store was positively associated number of fast-food restaurants. Number of fast-food restaurants were negatively associated with healthy family habits and child BMI percentile z-score. Higher neighborhood social and cultural cohesion was positively associated with family health habits. Higher child systolic blood pressure was positively associated with child diastolic blood pressure and BMI percentile z-score.

Primary Analyses

Hypothesis 1 examined the relationship between presence of a grocery store, number of fast-food restaurants, number of outdoor play spaces, and number of outdoor play safety indicators with child health variables (i.e., child systolic and diastolic blood pressure, BMI). Only the number of fast-food restaurants was significantly and negatively associated with BMI (model 6) indicating that more fast-food restaurants in a child's neighborhood was related to lower BMI percentile z score. This effect remained even when controlling for influence of family habits on BMI (Table 10, Figure 6). No other relationship between built environment and child health was found (Tables 5-16). Hypothesis 2 examined family habits as a mediator of the relation between neighborhood environment and child health. There were no significant indirect effects of built environment indicators on child health through family habits. Hypothesis 3 examined neighborhood social and cultural cohesion as a moderator on the relation between neighborhood environment and family habits. There was no significant moderation of NCC on the relation between neighborhood environment and family habits. Interestingly, for all models, neighborhood cultural cohesion was positively associated with healthy family habits after controlling for the effects of presence of a grocery store, number of fast-food restaurants, outdoor play spaces, and outdoor play safety on family habits.

These results indicate that mothers who reported engaging in healthier family habits also perceived more cohesion in their neighborhood.

Discussion

Ecological systems theory offers a comprehensive developmental framework to understand child physical health. Few studies have examined the exosystem (e.g., neighborhood), microsystem (e.g., family environment), and child-level (e.g., physical health) variables within the same model. Among a sample of low-income Mexican/Mexican American families, the current study aimed to determine how a family's neighborhood environment was associated with child health, whether family habits mediated the relation, and if neighborhood social and cultural cohesion moderated the association between neighborhood environment and family habits in the mediation model. The results of this study did not support our initial hypotheses.

Presence of a grocery store within a 400m radius of the family's home was not related to child systolic blood pressure, diastolic blood pressure, or BMI. The North American Industry Classification System (NAICS) refers to a grocery store as "a type of food store selling a general line of food, such as canned and frozen foods, fresh fruits and vegetables, and fresh and prepared meats, fish, and poultry." Studies typically consider presence of a grocery store to be protective against weight-related issues as it provides physical access to health foods such as fruits and vegetables. A 27-study meta-analysis examining the relation between grocery stores and child health outcomes found that while a few studies reported a negative or positive association between grocery store access and weight-related behaviors/outcomes, most studies found no significant association (Li et al., 2019). These findings were consistent across both cross-sectional and longitudinal studies. The null results support findings from an earlier systematic review that also found no association between grocery store availability and childhood obesity (Cobb et al., 2015).

There are several possibilities for the inconsistent findings across the literature. First, physical access to a grocery store alone does not capture variability in economic access to foods within the grocery stores. Past research suggests that affordability, acceptability, and accommodation are all likely key factors in how children and families interact with their surrounding food market (Penchansky & Thomas, 1981). The current sample's limited economic and transportation resources may differentiate the utility of a grocery store as an affordable nutrition resource compared to other food stores (e.g., convenience stores). Further, parents with limited economic resources (e.g., parents with food insecurity) may protect child's health through intra-household distribution of foods by allocating necessary resources to children to ensure children in the family are well nourished, regardless of opportunities in the neighborhood environment. Future research may consider the impact of neighborhood environment on both caregiver and child physical health to determine how the presence of a grocery store impacts the whole family unit. Second, cultural accessibility of different stores may encourage families to select a grocery store further outside of their immediate neighborhood environment to purchase products appropriate for their household meal plans. Our sample reflects a range of acculturative identities that may vary in adherence to American/Western commercial products and therefore may not choose to shop at the grocery store(s) within their neighborhood. Lastly, presence of a grocery store gives little information regarding which foods are purchased and how the food purchased is prepared for the child. The Focus and Food Insecurity and Vulnerability (2003) organization highlight "food utilization" as a core dimension of food insecurity that considers how children's nutrient intake varies according to biological and behavioral food practices. Building upon the current research to consider physical access, economic access, cultural acceptability, and food utilization will likely improve our future understanding of the relation between grocery stores and child physical health outcomes.

Contrary to initial hypotheses, increased physical access to fast-food restaurants was negatively associated with child BMI. Previous literature examining the relation between fast-food restaurants and weight behaviors/outcomes follows the mixed findings from the grocery store literature. Most studies do show a positive association between fast-food restaurants and fast-food consumption, however, almost no studies (1 out of 9 in a meta-analysis) have found an association between fast-food restaurants and continuous weight outcomes (Jia et al., 2019). An additional review previously cited also found that most studies purport no association between fast-food restaurant physical access and childhood obesity, with fewer studies showing a positive or negative association (Cobb et al., 2015). Jia and colleagues (2019) argue that variation of foods served at fast-food restaurants may account for mixed results in the literature. For example, a study conducted among Korean children found that access to Korean fast-food restaurants was associated with more fast-food consumption, although access to Western fast-food restaurants was not (Choo et al., 2017). Mothers within this study referred to the Korean options as more affordable, available, and accessible to children in the neighborhood. Our results may also reflect a similar trend. The current study's audit only included Western fast-food restaurants which may be less relevant for certain communities, particularly those of ethnic and low-socioeconomic status. Within a 400m radius there is limited physical space for restaurants and a greater amount of Western fast-food restaurants would theoretically offer less space for non-Western or ethnic fast-food restaurants. This decrease in proportional ethnic fast-food chains may have decreased the availability of more desirable chains and resulted in lower child consumption of fast food overall. Examining the presence of Latinx fast-food restaurants in this study may have yielded different results. Future research would benefit from examining whether Latinx fast-food restaurants differentially relate to family health behaviors and child weight outcomes compared to Western establishments.

Our findings could also be due to healthier family food choices. Knowledge of dietary guidelines has become more available for parents over time, and it is possible that parents' dietary choices have corresponded to recommendations (e.g., parents in our sample limiting their children's household access to fast food despite its growing neighborhood availability). However, our zero-order correlations showed a negative correlation between number of fast-food restaurants and family healthy habits. This may be due to fast-food restaurants influencing *how* families eat rather than *what* families eat. While parents may not feed their children fast food often, the adaptability of fast food (e.g., can be eaten anywhere, can be bought exclusively for one child) might establish unhealthy family habits (e.g., less family meals) that continue even when eating home prepared foods. Lastly, mothers in our sample may not have a food preference for the fast-food restaurants in their neighborhood due to food liking or economic reasons, and thus provide limited opportunity for their children to consume the specific fast foods in their environment. Previous research suggests that mothers influence children's food preferences via their own preferences, often limiting the diversity of foods offered to their children (Skinner et al., 2002). Interestingly, these trends remained stable from 2 years of age to 8 years. Future research may benefit from integrating information on maternal food preferences in determining interest and likelihood of consuming fast-food options.

Our hypotheses that outdoor play space and play safety would be positively associated with child health outcomes were also not supported. Previous research shows consistent associations between objective measures of environmental attributes (e.g., walkability, traffic speed, land-use mix) and physical activity among children (Ding et al., 2011). Interestingly, our results did not follow the current literature. This may be due to a variety of measurement issues. First, previous literature demonstrates that environmental influence on physical activity is domain-specific (e.g., transportation) and context-specific (e.g., walking). For example, presence of playgrounds and parks may increase child leisure time physical activity, although not increase the amount of walks the child takes with their parents around the neighborhood. Conversely, higher prevalence of sidewalks, streetlights, and traffic signs may make a neighborhood more walkable, although not increase recreational activity where moderate to vigorous child activity is more likely. Future research may benefit from examining domain-specific aspects of physical activity as a mediator between neighborhood environment and physical health. As per our physical health outcomes, it is possible that our current study did not capture additional important aspects of maternal perception of space and safety. Past research suggests despite outdoor spaces and safety appearing accessible, racial and income disparities remain in actual safety, maintenance, desirability, and use of outdoor spaces (Vaughan et al., 2013).

No neighborhood environment variables were related to healthy family habits in our study; however, maternal perceived neighborhood social and cultural cohesion was positively associated with healthy family habits in the majority of our models. Recent research suggests that perceived maternal social and cultural cohesion longitudinally promotes children's ethnic-racial identity affirmation and resolution processes (Pasco et al., in press). Previous research has demonstrated that a supportive neighborhood can promote positive family processes (Garcia Coll et al., 1996), which may include neighbors with mutual values and trusting relationships (Sampson et al., 1997) and an appreciation for one's own or shared heritage (Nair et al., 2013). Our findings suggest that maternal perceived neighborhood social and cultural cohesion is a key variable in promoting healthy family habits. Maternal support is an understudied construct in the child nutrition and physical activity literature. While many public health interventions consider physical health education as a primary mechanism of health promotion, few have considered the role maternal mental health plays in shaping the family nutrition and physical activity environment. Past research compared two neighborhoods with similar economic, social, and racial characteristics and found that fewer social exchanges and less use of neighborhood resources accounted for increases in child maltreatment

(Garbarino & Sherman, 1980). In contrast, social networks and social support serve as protective moderators of life stressors, increasing opportunity for positive well-being and parenting (Campbell & Lee, 1992). Future research may aim to examine the associations between various types of maternal social support (e.g., emotional, informational, tangible) and maternal feeding and encouragement of physical activity. In addition, higher stress, depression, and anxiety have been found to relate to nonresponsive feeding styles (Hurley et al., 2008) and parenting stress is negatively associated with moderate to vigorous childhood physical activity (Maher et al., 2017). Among Mexican American mothers, social support buffers the negative impact of multiple domains of stress on depressive symptoms (Coburn et al., 2016). Findings from the current study offer unique insight into the role of maternal perceived neighborhood cohesion on promoting healthy family habits.

The current study has a variety of limitations. First, while using a GIS technique increased the specificity of our neighborhood audit, it is difficult to compare our findings to census-level datasets given discrepancies between coverage areas. For example, a child's buffer region in our sample may have a buffer region that includes boundaries of multiple census tracts. Therefore, important information such as ethnic concentration, median household income, and crime rates collected at the census tract level were not included in our models as covariates. Second, due to our study being cross-sectional in nature, we were not able to prospectively predict changes in child health outcomes due to variability in neighborhood environment. Future research should aim to collect longitudinal data of the neighborhood environment to account for issues such as participant housing instability, temporal precedence of neighborhood's impact on health, and age appropriateness of neighborhood factors on developmental outcomes. Third, our study did not assess child's food consumption and therefore our analyses are not able to determine the relation between food environment and child eating. Fourth, our study was limited by the number of child physical health outcomes used. Future research may aim to integrate additional health indicators that have been shown to show the most predictive value of children's later health, such as appetite, metabolism, and insulin resistance (Oliver, 2006). In addition, the study did not examine the type or level of physical activity the child engaged in. More nuanced analyses on type of environment by child physical activity level may yield better understanding of how the built environment influences child physical activity and contributes to overall child health development.

Research examining the association between a child's neighborhood environment and their physical health is vastly inconclusive. Nevertheless, most research suggests that neighborhood influences alone do not fully predict children's health outcomes. Future studies may consider using a multilevel design clustering data by neighborhoods and examining various between-level (neighborhood-level) variables (e.g., fast-food restaurants, grocery stores) and within-level variables (e.g., family perceptions of neighborhood). This approach may improve our ability to attribute effects appropriately. Other structural equation models such as cross lagged panel designs may also be useful when testing the ecological systems perspective, for example by estimating bidirectional effects between neighborhood characteristics (e.g., indicators of gentrification) and neighborhood collective efficacy. This modeling approach might provide insight into components of successful lobbying efforts, community perceived cohesion, and sustainability of neighborhood health promoting structural components. A variety of longitudinal designs taking a holistic approach offers the most promise to reveal effective solutions in addressing health disparities among Mexican American youth. In an economic system that commonly disenfranchises and displaces Mexican American families, developmental theories such as the ecological systems perspective provide public health officials, activists, and clinicians a framework to support these families.

Table 1 of Sample Demographics

Variable Name	Min	Max	Mean	SD	%	*n*
Mother's Age	23	47	32.56	6.42		213
Mother's Country of Birth						
United States					11	22
Mexico					89	191
Child's Sex						
Male					46.5	99
Female					53.5	115
Marital Status						
Married					45	96
Living with partner					35	75
Never married or Separated/Divorced					20	43
Estimated Total Income						
≤ $5,000					5.7	12
$5,001 – 10,000					13.3	28
$10,001 – 15,000					13.7	29
$15,001 – 20,000					19.4	41
$20,001 – 25,000					11.8	25
≥ $25,001					36.1	79

Note. N = 214; Living with partner are mothers who are not married but living with a partner.

Table 2 of Descriptive Statistics

	M (SD)	Skewness (SD)	Kurtosis (SD)
Fast Food	0.88 (1.46)	2.06 (.17)	4.39 (.33)
Space	0.97 (1.37)	1.58 (.17)	2.33 (.33)
Safety	3.49 (0.63)	0.22 (.17)	1.35 (.33)
NCC	37.0 (11.0)	-0.13 (.17)	-0.58 (.34)
FNPA	40.80 (6.29)	-0.00 (.17)	-0.56 (.33)
SYS BP	96.22 (8.24)	0.07 (.18)	-0.48 (.36)
DIA BP	56.19 (10.49)	0.48 (.18)	0.03 (.35)
BMI	0.73 (1.36)	0.78 (.17)	1.13 (.35)

Note. N = 214. M = Mean; SD = Standard Deviation. NCC = neighborhood cultural cohesion; FNPA = Healthy Family Habits; SYS BP = systolic blood pressure; DIA BP = diastolic blood pressure; BMI = Body Mass Index percentile z score.

Table 3 of Correlations Between Study Variables

	Grocery	Fast Food	Space	Safety	NCC	FNPA	SYS BP	DIA BP	BMI
Grocery	-								
Fast Food	**.471**	-							
Space	-.110	-.107	-						
Safety	.102	.075	.088	-					
NCC	-.022	-.128	.042	.106	-				
FNPA	-.064	**-.155**	-.034	.073	**.302**	-			
SYS BP	-.147	-.003	.029	.057	.094	.059	-		
DIA BP	-.016	.074	-.038	-.038	.010	.046	**.524**	-	
BMI	-.105	**-.187**	.100	.006	-.014	-.015	**.243**	**.164**	-

Note. N = 214. Grocery = dummy code for presence of grocery store and no corner; NCC = neighborhood cultural cohesion; FNPA = Healthy Family Habits; SYS BP = systolic blood pressure; DIA BP = diastolic blood pressure; BMI = Body Mass Index percentile z score. Pairwise deletion was used. Bolded values are significant at $p < .05$.

Table 4 Relationships between Grocery Store, NCC, Family Habits, and Systolic Blood Pressure

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Grocery	-0.73	.83	-0.88	-2.4	.90
NCC	**0.16**	**.05**	**3.20**	**.06**	**.26**
Grocery x NCC	0.01	.08	-0.22	-.13	.16
	Systolic Blood Pressure				
Dependent Variable Model					
Grocery	-2.39	1.2	-1.92	-4.8	.05
Family Habits	0.06	.10	0.61	-.13	.25
Conditional Indirect Effects					
Grocery					
-1 SD	-0.05	.11	-0.47	-.27	.17
Mean	-0.04	.09	-0.50	-.21	.13
+1 SD	-0.04	.09	-0.38	-.21	.14

Note. N = 214. Grocery = dummy code for presence of grocery store and no corner; NCC = neighborhood cultural cohesion, continuous moderator; G x NCC = interaction term between Grocery and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. Systolic BP = blood pressure. Results significant at $p < .05$ are bolded.

Table 5 Relationships between Grocery Store, NCC, Family Habits, and Diastolic Blood Pressure

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Grocery	-0.73	.83	-0.88	-2.4	.90
NCC	**0.16**	**.05**	**3.20**	**.06**	**.26**
Grocery x NCC	0.01	.08	0.18	-.13	.16
	Diastolic BP				
Dependent Variable Model					
Grocery	-0.26	1.5	-0.17	-3.3	2.7
Family Habits	0.08	.12	0.63	-.16	.32
Conditional Indirect Effects					
Grocery					
-1 SD	-0.07	.14	-0.48	-.34	.21
Mean	-0.06	.11	-0.51	-.27	.16
+1 SD	-0.04	.12	-0.39	-.27	.18

Note. N = 214. Grocery = dummy code for presence of grocery store and no corner; NCC = neighborhood cultural cohesion, continuous moderator; G x NCC = interaction term between Grocery and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. Systolic BP = blood pressure. Results significant at $p < .05$ are bolded.

Table 6 Relationships between Grocery Store, NCC, Family Habits, and BMI

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Grocery	-0.73	.83	-0.88	-2.4	.90
NCC	**0.16**	**.05**	**3.20**	**.06**	**.26**
Grocery x NCC	0.01	.08	0.18	-.13	.16
			BMI		
Dependent Variable Model					
Grocery	-0.29	.20	-1.50	-.68	.09
Family Habits	-0.01	.02	-0.29	-.04	.03
Conditional Indirect Effects					
Grocery					
-1 SD	0.00	0.01	0.27	-.03	.03
Mean	0.00	0.01	0.28	-.02	.03
+1 SD	0.00	0.01	0.25	-.02	.02

Note. N = 214. Grocery = dummy code for presence of grocery store and no corner; NCC = neighborhood cultural cohesion, continuous moderator; G x NCC = interaction term between Grocery and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. Systolic BP = blood pressure. Results significant at p < .05 are bolded.

Table 7 Relationships between Fast Food Restaurants, NCC, Family Habits, and Systolic Blood Pressure

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Fast Food (FF)	-0.54	.30	-1.80	-1.2	.05
NCC	**0.17**	**.04**	**3.81**	**.08**	**.25**
FF x NCC	-0.01	.02	-0.24	-.05	.04
	Systolic BP				
Dependent Variable Model					
Fast Food	0.05	.42	0.13	-.77	.88
Family Habits	0.08	.10	0.79	-.12	.28
Conditional Indirect Effects					
-1 SD	-0.04	.06	-0.70	-.15	.07
Mean	-0.04	.06	-0.73	-.16	.07
+1 SD	-0.05	.07	-0.68	-.19	.09

Note. N = 214. Fast Food = number of Fast-food restaurants; NCC = neighborhood cultural cohesion, continuous moderator; FF x NCC = interaction term between Fast Food and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. Systolic BP = blood pressure. Results significant at $p < .05$ are bolded.

Table 8 Relationships between Fast Food Restaurants, NCC, Family Habits, and Diastolic Blood Pressure

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Fast Food (FF)	-0.54	.30	-1.80	-1.2	.05
NCC	**0.17**	**.04**	**3.81**	**.08**	**.25**
FF x NCC	-0.01	.02	-0.24	-.05	.04
	Diastolic BP				
Dependent Variable Model					
Fast Food	0.61	.52	1.18	-.41	1.6
Family Habits	0.11	.13	0.86	-.14	.04
Conditional Indirect Effects					
-1 SD	-0.05	.07	-0.74	-.02	.08
Mean	-0.06	.07	-0.78	-.20	.09
+1 SD	-0.06	.09	-0.72	-.24	.11

Note. N = 214. Fast Food = number of Fast-food restaurants; NCC = neighborhood cultural cohesion, continuous moderator; FF x NCC = interaction term between Fast Food and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. Diastolic BP = blood pressure. Results significant at $p < .05$ are bolded.

Table 9 Relationships between Fast Food Restaurants, NCC, Family Habits, and BMI

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Fast Food (FF)	-0.54	.30	-1.80	-1.2	.05
NCC	**0.17**	**.04**	**3.81**	**.08**	**.25**
FF x NCC	-0.01	.02	-0.24	-.05	.04
	BMI				
Dependent Variable Model					
Fast Food	**-0.18**	**.07**	**-2.73**	**-.30**	**-.05**
Family Habits	-0.01	.02	-0.62	-.04	.02
Conditional Indirect Effects					
-1 SD	0.01	.01	0.57	-.01	.02
Mean	0.01	.01	0.59	-.01	.02
+1 SD	0.01	.01	0.56	-.01	.03

Note. N = 214. Fast Food = number of fast-food restaurants; NCC = neighborhood cultural cohesion, continuous moderator; FF x NCC = interaction term between Fast Food and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. BMI = Body Mass Index percentile z score. Results significant at $p < .05$ are bolded.

Table 9 Relationships between Fast Food Restaurants, NCC, Family Habits, and BMI

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Fast Food (FF)	-0.54	.30	-1.80	-1.2	.05
NCC	**0.17**	**.04**	**3.81**	**.08**	**.25**
FF x NCC	-0.01	.02	-0.24	-.05	.04
	BMI				
Dependent Variable Model					
Fast Food	**-0.18**	**.07**	**-2.73**	**-.30**	**-.05**
Family Habits	-0.01	.02	-0.62	-.04	.02
Conditional Indirect Effects					
-1 SD	0.01	.01	0.57	-.01	.02
Mean	0.01	.01	0.59	-.01	.02
+1 SD	0.01	.01	0.56	-.01	.03

Note. N = 214. Fast Food = number of fast-food restaurants; NCC = neighborhood cultural cohesion, continuous moderator; FF x NCC = interaction term between Fast Food and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. BMI = Body Mass Index percentile z score. Results significant at $p < .05$ are bolded.

Table 10 Relationships between Outdoor Space, NCC, Family Habits, and Systolic Blood Pressure

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Space	-0.23	.30	-0.78	-.83	.36
NCC	**0.18**	**.04**	**4.66**	**.10**	**.25**
Space x NCC	0.03	.03	1.05	-.03	.10
	Systolic BP				
Dependent Variable Model					
Space	0.17	.45	0.39	-.70	1.0
Family Habits	0.10	.10	0.78	-.12	.27
Conditional Indirect Effects					
-1 SD	-0.05	.07	-0.67	-.18	.09
Mean	-0.02	.03	-0.55	-.08	.05
+1 SD	0.01	.04	0.26	-.06	.08

Note. N = 213. Space = sum of parks, playgrounds, sports fields, trails, and pools; NCC = neighborhood cultural cohesion, continuous moderator; Space x NCC = interaction term between Space and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. Systolic BP = blood pressure percentile. Results significant at $p < .05$ are bolded.

Table 11 Relationships between Outdoor Space, NCC, Family Habits, and Diastolic Blood Pressure

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Space	-0.23	.30	-0.78	-.83	.36
NCC	**0.18**	**.04**	**4.66**	**.10**	**.25**
Space x NCC	0.03	.03	1.05	-.03	.10
	Diastolic BP				
Dependent Variable Model					
Space	-0.28	.54	-0.51	-1.3	.79
Family Habits	0.08	.12	0.63	-.16	.32
Conditional Indirect Effects					
-1 SD	-0.05	.08	-0.56	-.20	.11
Mean	-0.02	.04	-0.49	-.09	.05
+1 SD	0.01	.04	0.25	-.06	.08

Note. N = 213. Space = sum of parks, playgrounds, sports fields, trails, and pools; NCC = neighborhood cultural cohesion, continuous moderator; Space x NCC = interaction term between Space and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. Diastolic BP = blood pressure percentile. Results significant at $p < .05$ are bolded.

Table 12 Relationships between Outdoor Space, NCC, Family Habits, and BMI

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Space	-0.23	.30	-0.78	-.83	.36
NCC	**0.18**	**.04**	**4.66**	**.10**	**.25**
Space x NCC	0.03	.03	1.05	-.03	.10
	BMI				
Dependent Variable Model					
Space	0.10	.07	1.40	-.04	.24
Family Habits	-0.02	.02	-0.11	-.03	.03
Conditional Indirect Effects					
-1 SD	0.00	0.01	0.11	-.02	.02
Mean	0.00	0.01	0.11	-.01	.01
+1 SD	0.00	0.00	-0.11	-.00	.00

Note. N = 213. Space = sum of parks, playgrounds, sports fields, trails, and pools; NCC = neighborhood cultural cohesion, continuous moderator; Space x NCC = interaction term between Space and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. BMI = Body Mass Index percentile z score. Results significant at $p < .05$ are bolded.

Table 13 Relationships between Outdoor Safety, NCC, Family Habits, and Systolic Blood Pressure

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Safety	0.45	.66	0.68	-.85	1.8
NCC	**0.17**	**.04**	**4.41**	**.09**	**.24**
Safety x NCC	-0.02	.06	-0.31	-.14	.10
	Systolic BP				
Dependent Variable Model					
Safety	0.68	1.0	0.68	-1.3	2.6
Family Habits	0.07	.10	0.71	-.12	.26
Conditional Indirect Effects					
-1 SD	0.05	.09	0.49	-.14	.23
Mean	0.03	.07	0.49	-.10	.16
+1 SD	0.02	.07	0.26	-.11	.15

Note. N = 214. Safety = percentage of streets present with streetlight, a sidewalk, traffic sign, or speed bump; NCC = neighborhood cultural cohesion, continuous moderator; Safety x NCC = interaction term between Safety and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. Systolic BP = blood pressure percentile. Results significant at $p < .05$ are bolded.

Table 14 Relationships between Outdoor Safety, NCC, Family Habits, and Diastolic Blood Pressure

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Safety	0.45	.66	0.68	-.85	1.8
NCC	**0.17**	**.04**	**4.41**	**.09**	**.24**
Safety x NCC	-0.02	.06	-0.31	-.14	.10
	Diastolic BP				
Dependent Variable Model					
Safety	-0.91	1.2	-0.76	-3.3	1.4
Family Habits	0.08	.12	0.69	-.16	.32
Conditional Indirect Effects					
-1 SD	0.06	.12	0.48	-.17	.28
Mean	0.04	.08	0.48	-.12	.19
+1 SD	0.02	.08	0.26	-.14	.18

Note. N = 214. Safety = percentage of streets present with streetlight, a sidewalk, traffic sign, or speed bump; NCC = neighborhood cultural cohesion, continuous moderator; Safety x NCC = interaction term between Safety and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. Diastolic BP = blood pressure percentile. Results significant at $p < .05$ are bolded.

Table 15 Relationships between Outdoor Safety, NCC, Family Habits, and BMI

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Safety	0.45	.66	0.68	-.85	1.8
NCC	**0.17**	**.04**	**4.41**	**.09**	**.24**
Safety x NCC	-0.02	.06	-0.31	-.14	.10
	BMI				
Dependent Variable Model					
Safety	0.02	.15	0.10	-.29	.32
Family Habits	-0.00	.02	-0.21	-.03	.03
Conditional Indirect Effects					
-1 SD	-0.00	.01	-0.20	-.02	.02
Mean	-0.00	.01	-0.20	-.02	.01
+1 SD	-0.00	.01	-0.17	-.01	.01

Note. N = 214. Safety = percentage of streets present with streetlight, a sidewalk, traffic sign, or speed bump; NCC = neighborhood cultural cohesion, continuous moderator; Safety x NCC = interaction term between Safety and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. BMI = Body Mass Index percentile z score. Results significant at $p < .05$ are bolded.

Table 16 Relationships between Outdoor Safety, NCC, Family Habits, and BMI

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Safety	0.45	.66	0.68	-.85	1.8
NCC	**0.17**	**.04**	**4.41**	**.09**	**.24**
Safety x NCC	-0.02	.06	-0.31	-.14	.10
	BMI				
Dependent Variable Model					
Safety	0.02	.15	0.10	-.29	.32
Family Habits	-0.00	.02	-0.21	-.03	.03
Conditional Indirect Effects					
-1 SD	-0.00	.01	-0.20	-.02	.02
Mean	-0.00	.01	-0.20	-.02	.01
+1 SD	-0.00	.01	-0.17	-.01	.01

Note. N = 214. Safety = percentage of streets present with streetlight, a sidewalk, traffic sign, or speed bump; NCC = neighborhood cultural cohesion, continuous moderator; Safety x NCC = interaction term between Safety and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. BMI = Body Mass Index percentile z score. Results significant at $p < .05$ are bolded.

Table 16 Relationships between Outdoor Safety, NCC, Family Habits, and BMI

	Family Habits				
	b	*SE*	*t value*	*LL CI 95%*	*UL CI 95%*
Mediator Variable Model					
Safety	0.45	.66	0.68	-.85	1.8
NCC	**0.17**	**.04**	**4.41**	**.09**	**.24**
Safety x NCC	-0.02	.06	-0.31	-.14	.10
	BMI				
Dependent Variable Model					
Safety	0.02	.15	0.10	-.29	.32
Family Habits	-0.00	.02	-0.21	-.03	.03
Conditional Indirect Effects					
-1 SD	-0.00	.01	-0.20	-.02	.02
Mean	-0.00	.01	-0.20	-.02	.01
+1 SD	-0.00	.01	-0.17	-.01	.01

Note. N = 214. Safety = percentage of streets present with streetlight, a sidewalk, traffic sign, or speed bump; NCC = neighborhood cultural cohesion, continuous moderator; Safety x NCC = interaction term between Safety and NCC. Conditional indirect effects were estimated 11.004 units below, above, and at the mean of NCC. LL CI 95% = lower limit of 95% confidence interval; UL CI 95% = upper limit of 95% confidence interval. BMI = Body Mass Index percentile z score. Results significant at $p < .05$ are bolded.

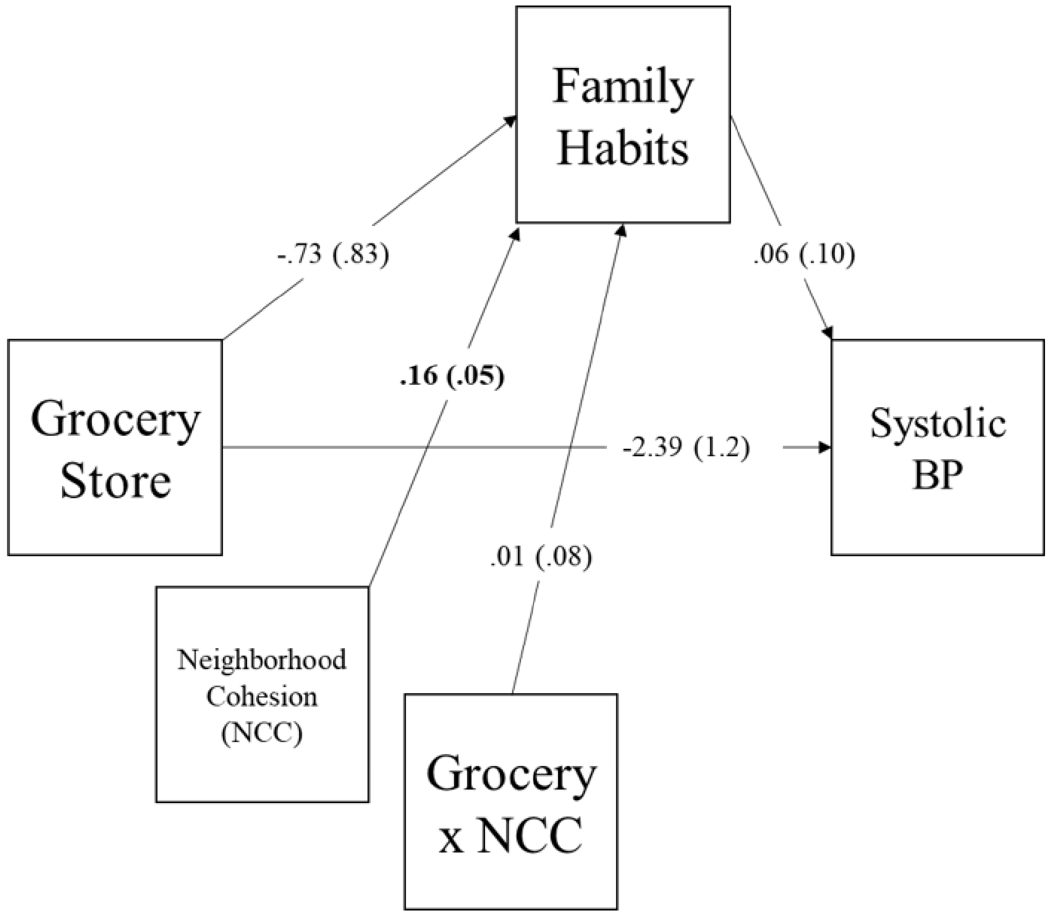

Figure 4. Statistical model for Model 1, estimating direct effects of systolic blood pressure percentile regressed on predictors (i.e., dummy codes for presence of corner store only, presence of grocery store only, and presence of corner and grocery store) and on the mediator (i.e., family habits), and mediator on the moderator (i.e., NCC = neighborhood cultural cohesion) and interaction terms. No significant indirect or conditional indirect effects were found.

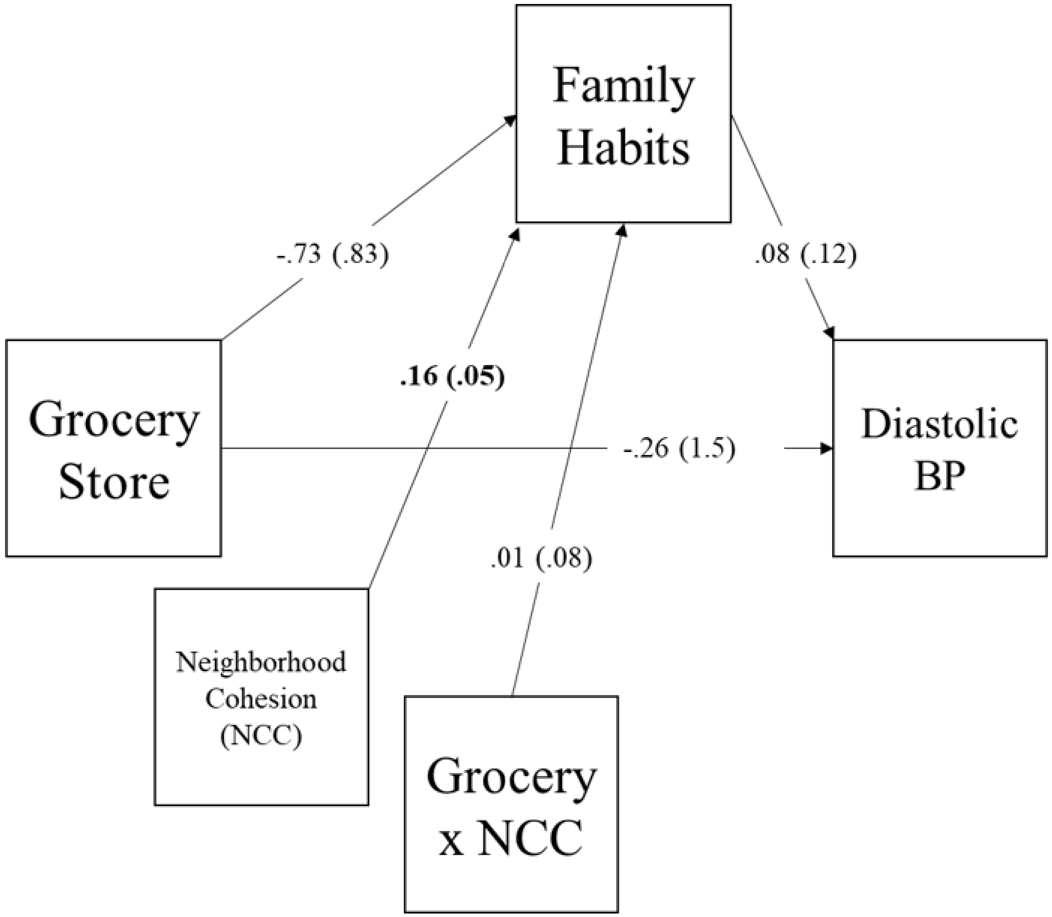

Figure 5. Statistical model for Model 2, estimating direct effects of diastolic blood pressure percentile regressed on predictors (i.e., dummy codes for presence of corner store only, presence of grocery store only, and presence of corner and grocery store) and on the mediator (i.e., family habits), and mediator on the moderator (i.e., NCC = neighborhood cultural cohesion) and interaction terms. No significant indirect or conditional indirect effects were found.

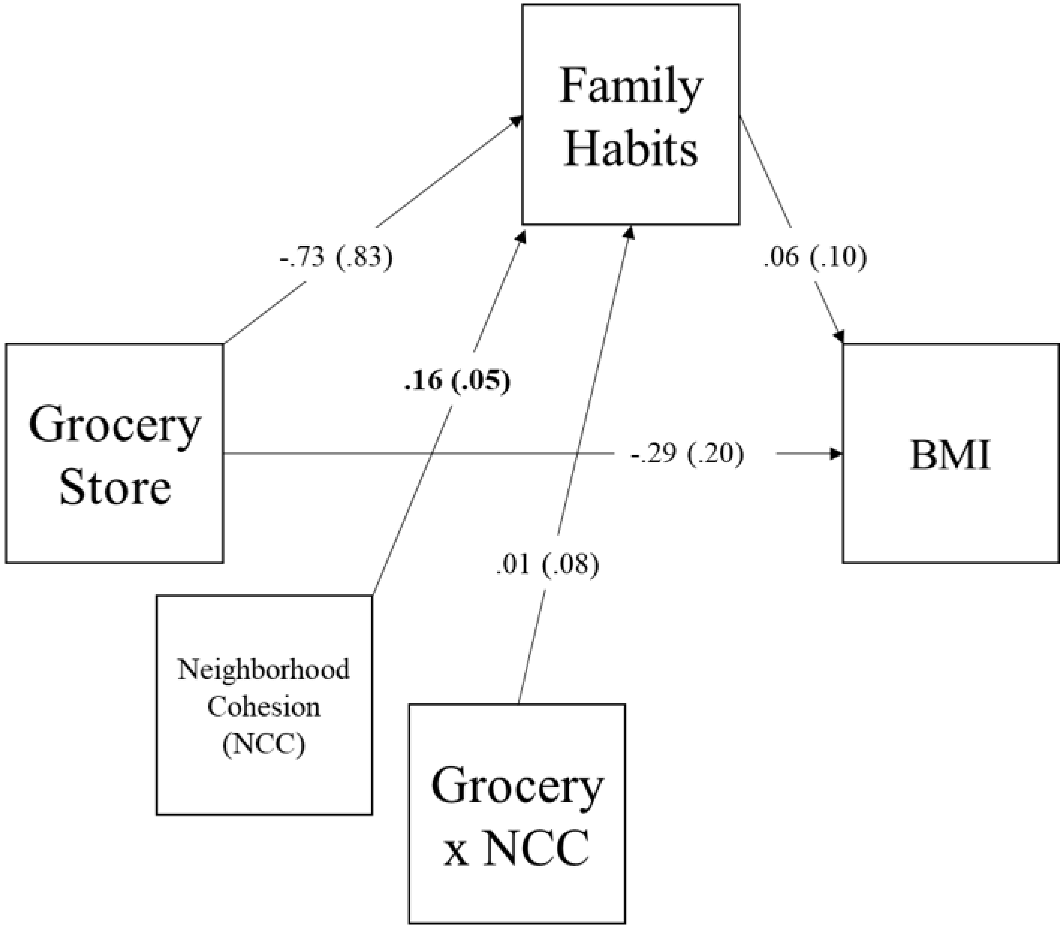

Figure 6. Statistical model for Model 3, estimating direct effects of BMI percentile z score regressed on predictors (i.e., dummy codes for presence of corner store only, presence of grocery store only, and presence of corner and grocery store) and on the mediator (i.e., family habits), and mediator on the moderator (i.e., NCC = neighborhood cultural cohesion) and interaction terms. No significant indirect or conditional indirect effects were found.

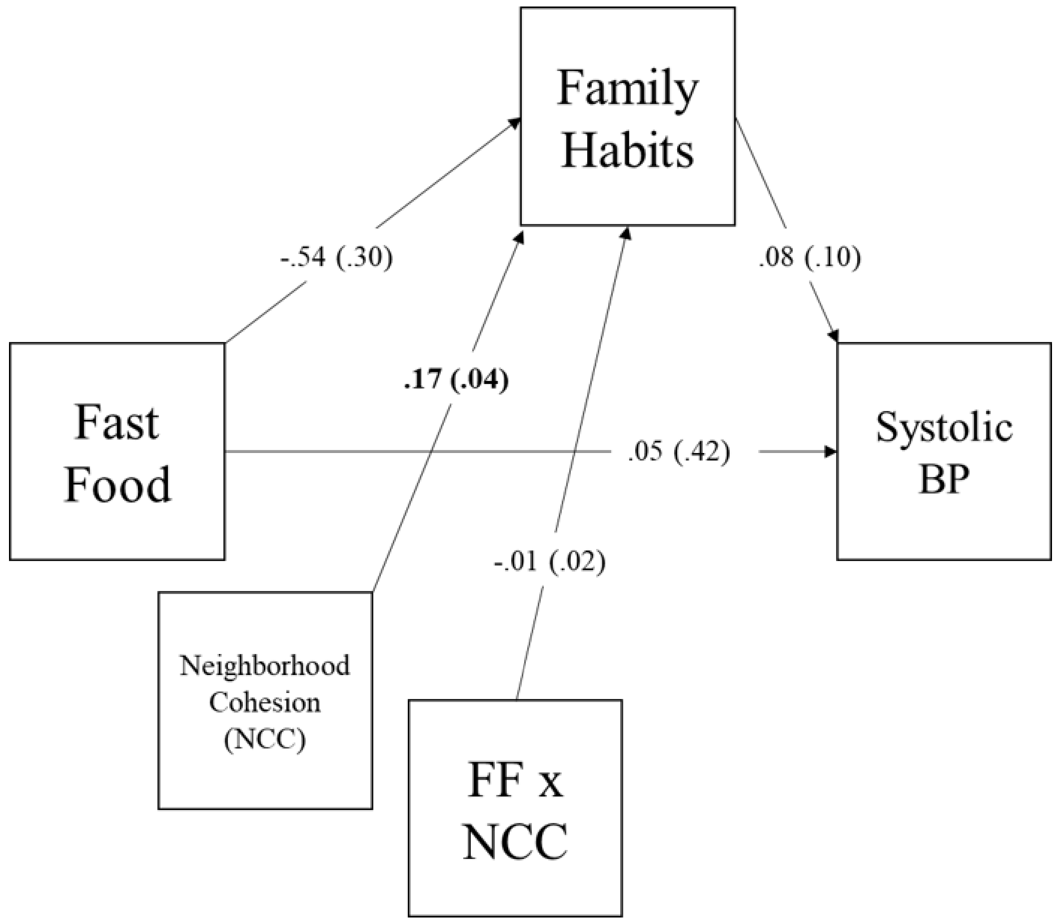

Figure 7. Statistical model for Model 4, estimating direct effects of systolic blood pressure percentile regressed on predictor (i.e., fast-food restaurants) and on the mediator (i.e., family habits), and mediator on the moderator (i.e., NCC = neighborhood cultural cohesion) and interaction term. Significant direct effects at $p < .05$ are bolded. No significant indirect or conditional indirect effects were found.

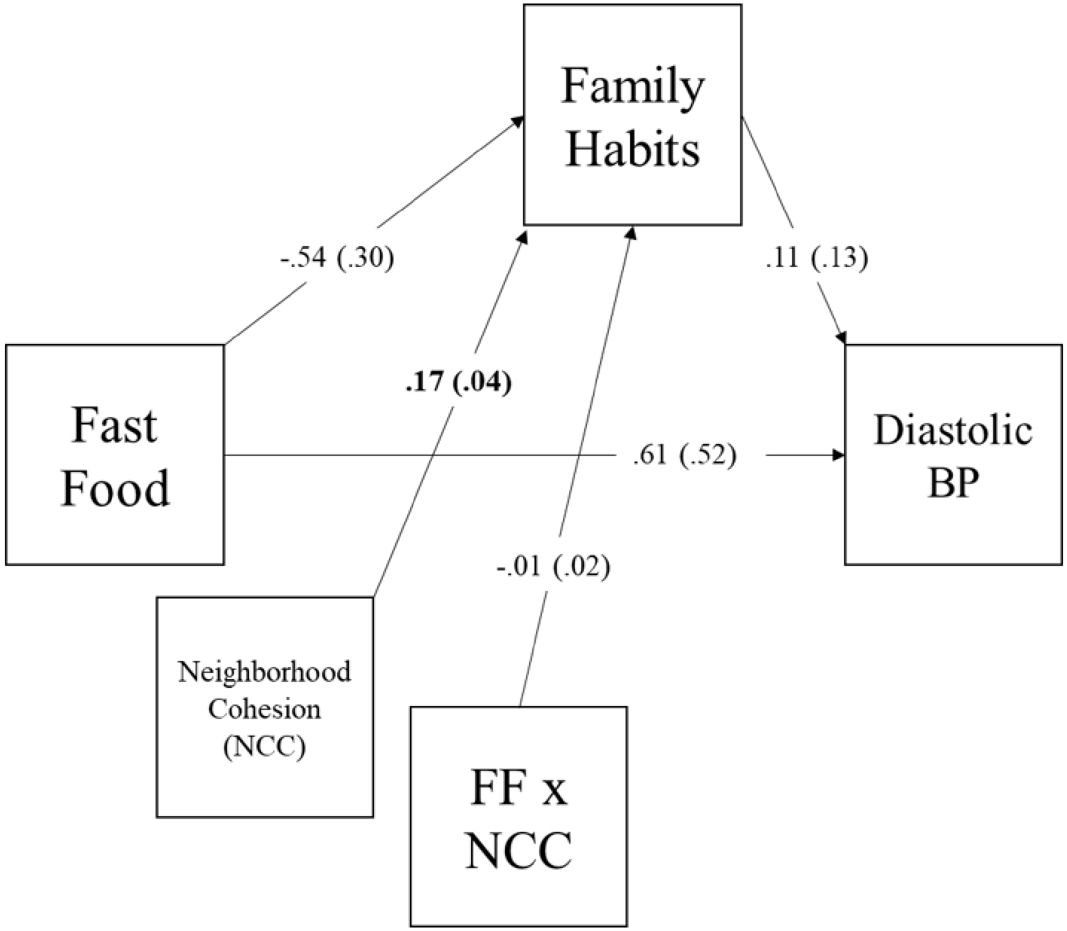

Figure 8. Statistical model for Model 5, estimating direct effects of diastolic blood pressure percentile regressed on predictor (i.e., fast-food restaurants) and on the mediator (i.e., family habits), and mediator on the moderator (i.e., NCC = neighborhood cultural cohesion) and interaction term. Significant direct effects at $p < .05$ are bolded. No significant indirect or conditional indirect effects were found.

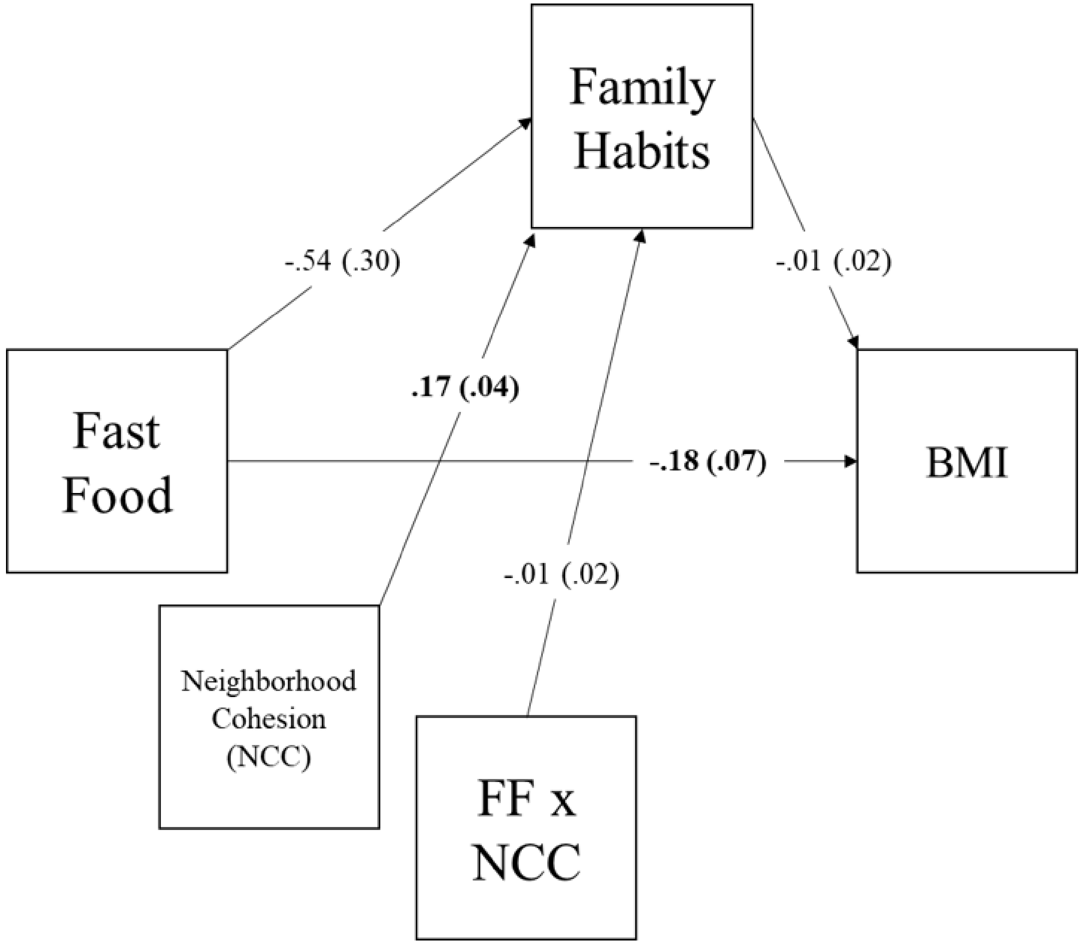

Figure 9. Statistical model for Model 6, estimating direct effects of BMI percentile z score regressed on predictor (i.e., fast-food restaurants) and on the mediator (i.e., family habits), and mediator on the moderator (i.e., NCC = neighborhood cultural cohesion) and interaction term. Significant direct effects at $p < .05$ are bolded. No significant indirect or conditional indirect effects were found.

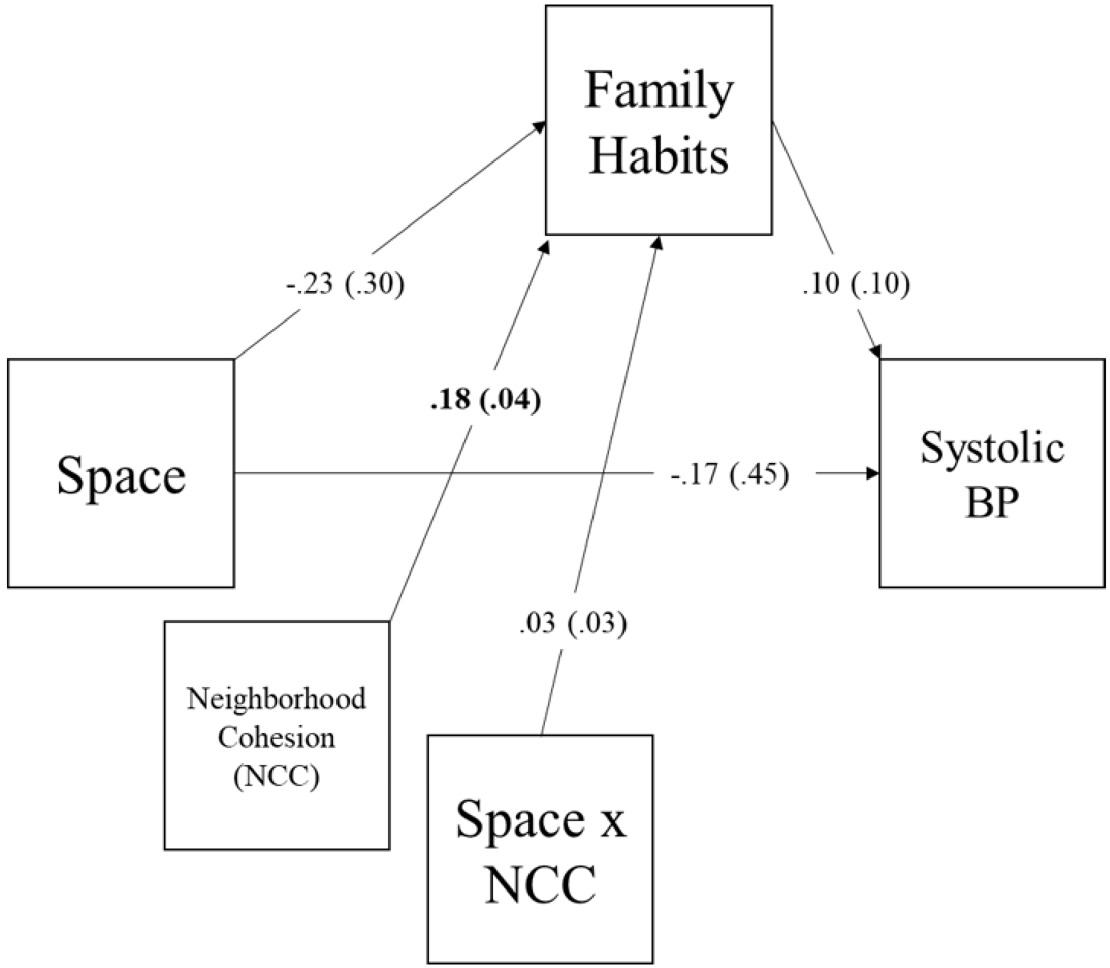

Figure 10. Statistical model for Model 7, estimating direct effects of systolic blood pressure percentile regressed on predictor (i.e., space) and on the mediator (i.e., family habits), and mediator on the moderator (i.e., NCC = neighborhood cultural cohesion) and interaction term. Significant direct effects at p < .05 are bolded. No significant indirect or conditional indirect effects were found.

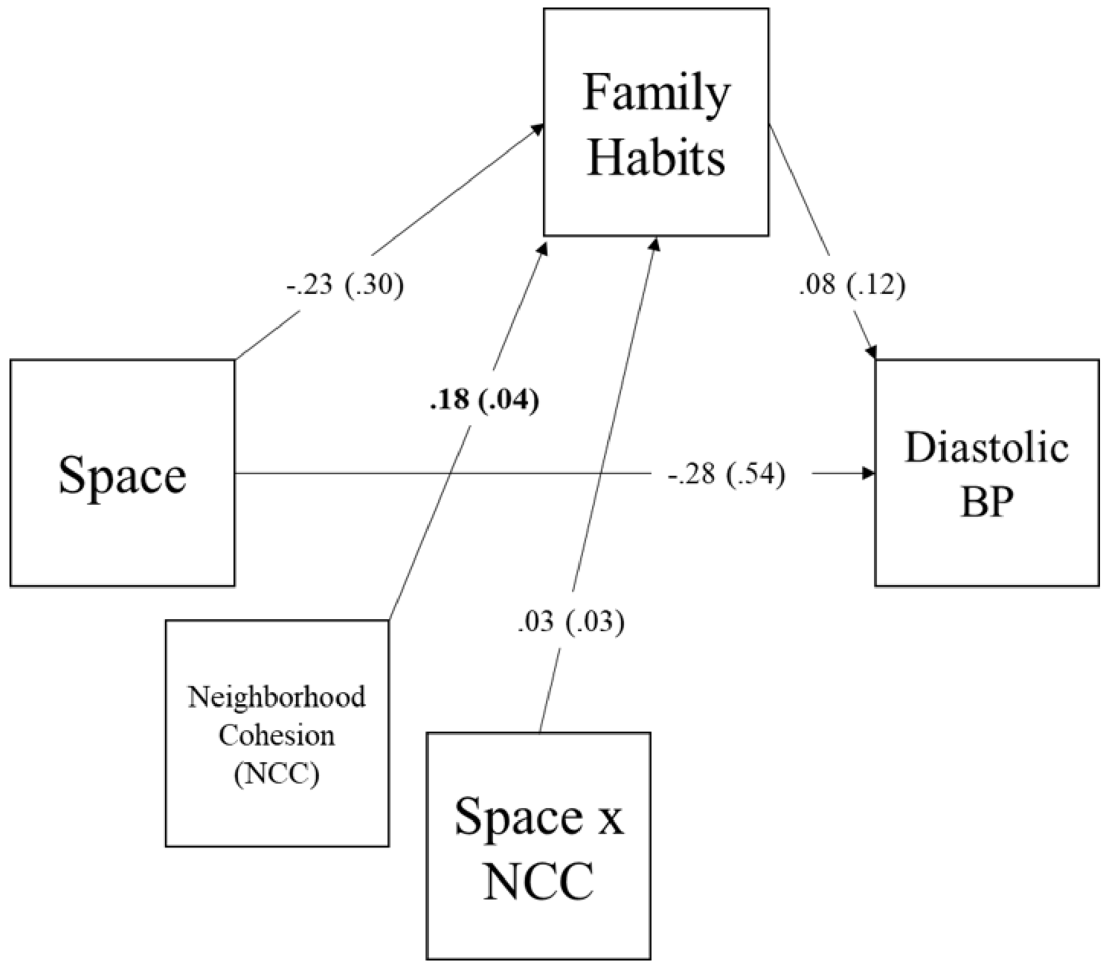

Figure 11. Statistical model for Model 8, estimating direct effects of diastolic blood pressure percentile regressed on predictor (i.e., space) and on the mediator (i.e., family habits), and mediator on the moderator (i.e., NCC = neighborhood cultural cohesion) and interaction term. Significant direct effects at $p < .05$ are bolded. No significant indirect or conditional indirect effects were found.

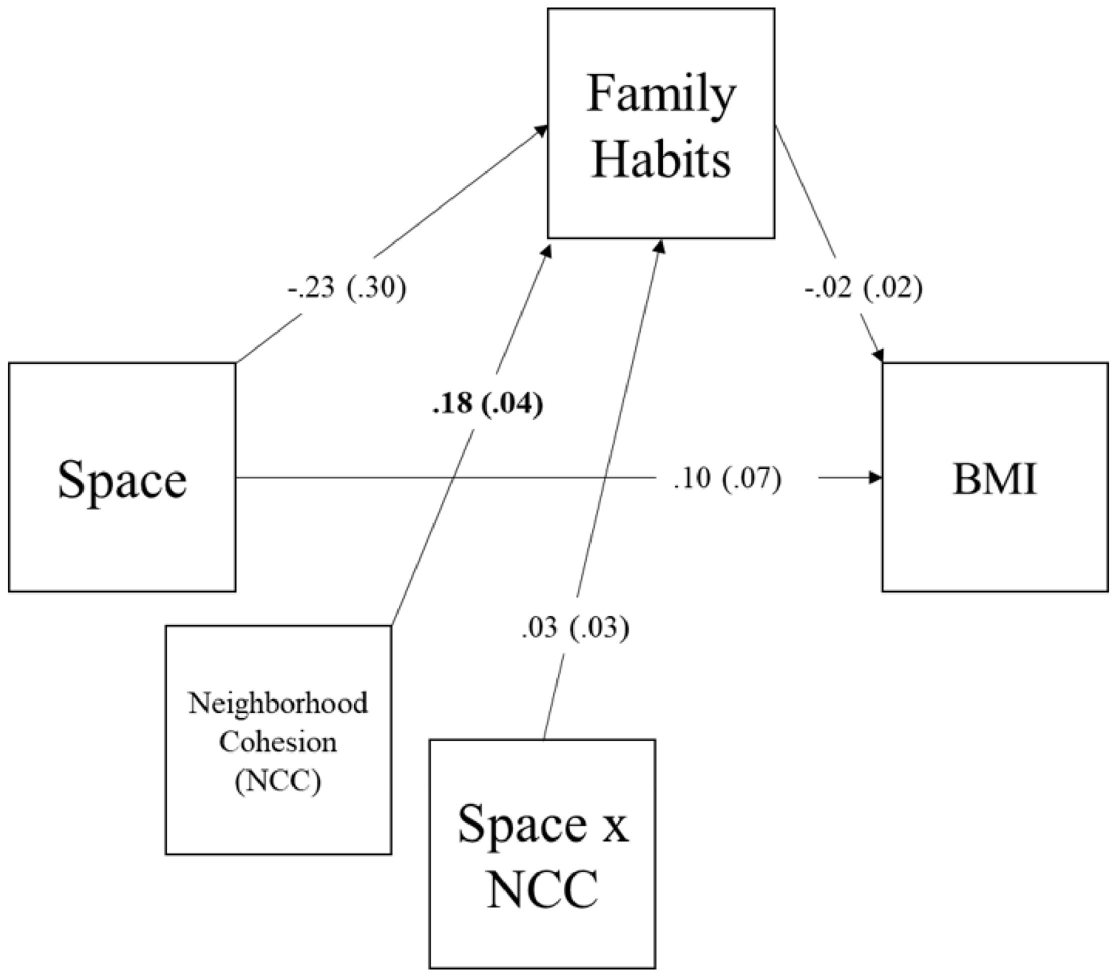

Figure 12. Statistical model for Model 9, estimating direct effects of BMI percentile z score percentile regressed on predictor (i.e., space) and on the mediator (i.e., family habits), and mediator on the moderator (i.e., NCC = neighborhood cultural cohesion) and interaction term. Significant direct effects at $p < .05$ are bolded. No significant indirect or conditional indirect effects were found.

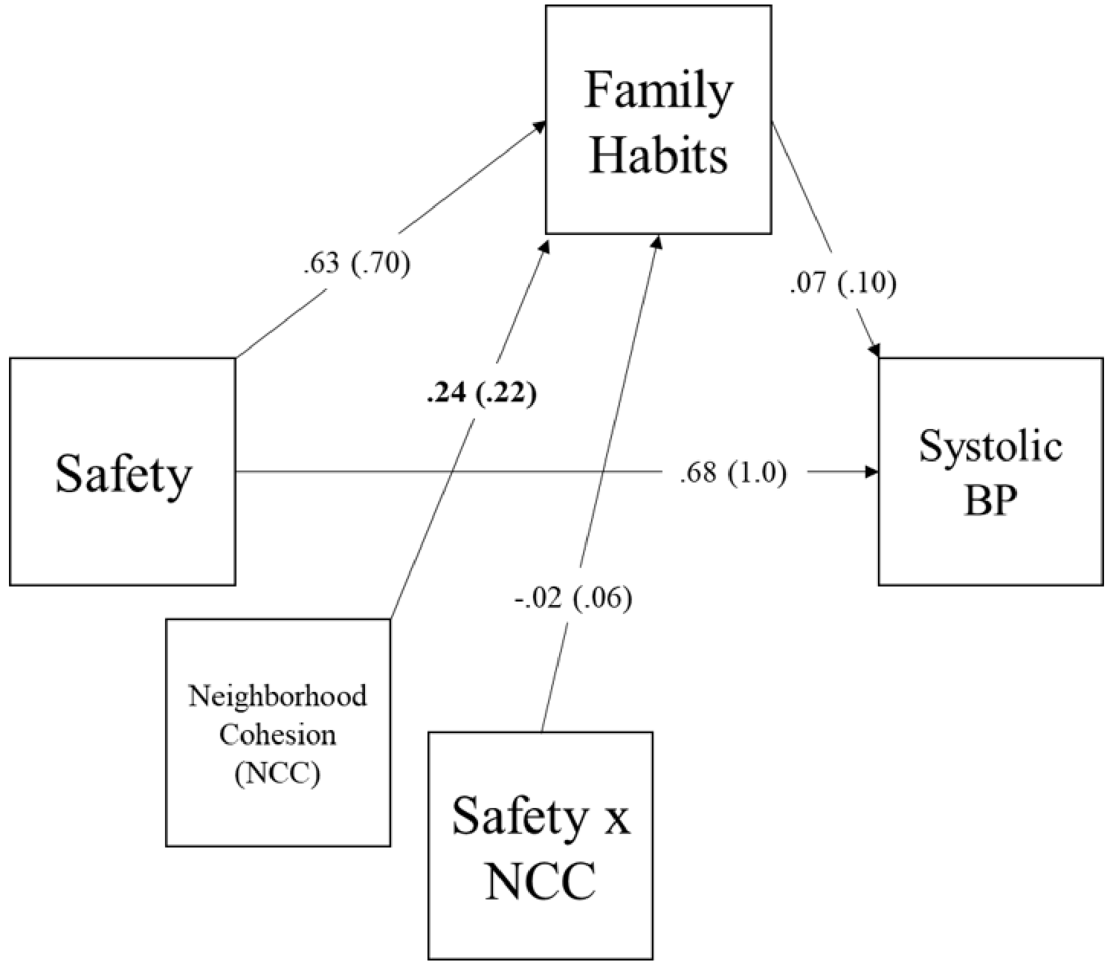

Figure 13. Statistical model for Model 10, estimating direct effects of systolic blood pressure percentile regressed on predictor (i.e., safety) and on the mediator (i.e., family habits), and mediator on the moderator (i.e., NCC = neighborhood cultural cohesion) and interaction term. Significant direct effects at $p < .05$ are bolded. No significant indirect or conditional indirect effects were found.

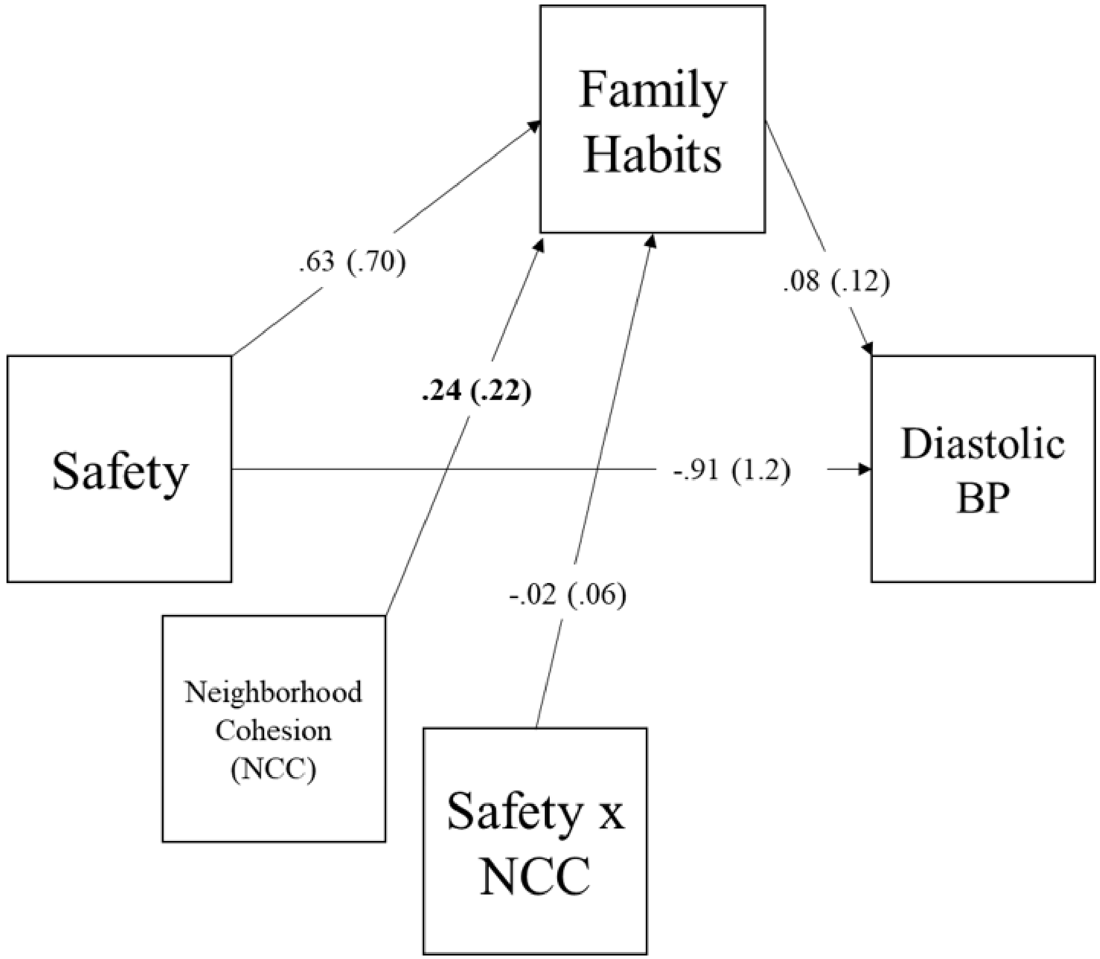

Figure 14. Statistical model for Model 11, estimating direct effects of diastolic blood pressure percentile regressed on predictor (i.e., safety) and on the mediator (i.e., family habits), and mediator on the moderator (i.e., NCC = neighborhood cultural cohesion) and interaction term. Significant direct effects at p < .05 are bolded. No significant indirect or conditional indirect effects were found.

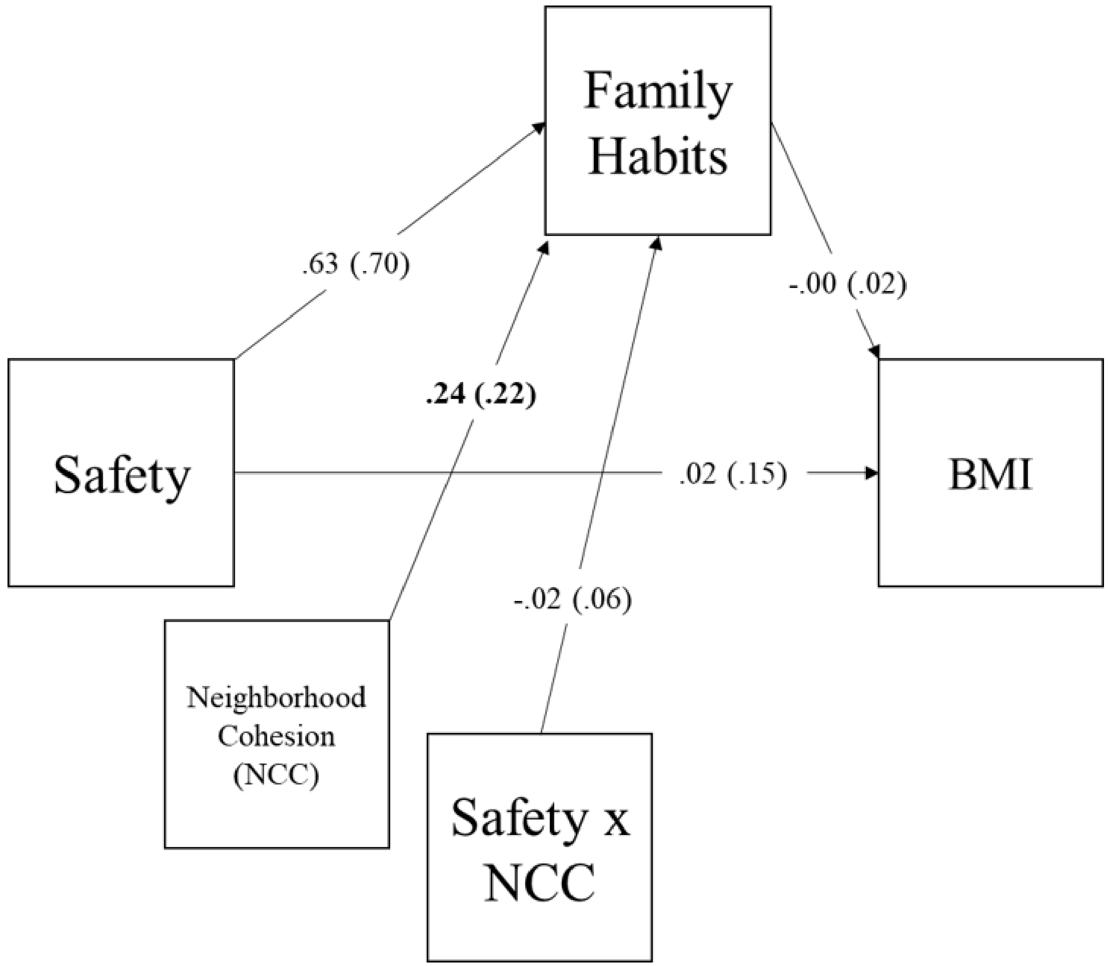

Figure 15. Statistical model for Model 12, estimating direct effects of BMI percentile z score percentile regressed on predictor (i.e., safety) and on the mediator (i.e., family habits), and mediator on the moderator (i.e., NCC = neighborhood cultural cohesion) and interaction term. Significant direct effects at $p < .05$ are bolded. No significant indirect or conditional indirect effects were found.

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APPENDIX A

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