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Childhood neighborhoods and health: Census-based neighborhood measures versus residential lived experiences

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ABSTRACT

This study examines the impact of neighborhood disadvantage and neighborhood social connectedness during childhood on subsequent health status during early adulthood. We link longitudinal data from the Panel Study of Income Dynamics with Census data on children's surrounding neighborhoods. We estimate results with conventional linear regression and novel methods that better adjust for neighborhood selection processes. We find that neighborhood connectedness in childhood is protective against psychological distress in early adulthood, net of selection effects. However, greater connectedness exacerbates the risk of obesity within disadvantaged contexts for Black youth. Our results highlight a potential pathway for improving population health by investing in the social connectedness of neighborhoods alongside reducing structural inequalities.

1. Introduction

Children who grow up in disadvantaged neighborhoods experience worse health later in life (Sharkey and Elwert, 2011; Johnson et al., 2012; Alvarado, 2016b). Childhood neighborhoods may be particularly salient for health because they are highly influential for subsequent residential trajectories, influencing contextual contributions to health over the life course (Gustafsson et al., 2014; Lee et al., 2017). However, most studies of neighborhood effects have been limited to Census-based neighborhood measures such as poverty rates or racial compositions. These typical measures of neighborhoods may not capture the full variation and nuance of how and why neighborhoods matter. If we want to understand the impact of childhood neighborhoods on subsequent health – what factors are most important?

Prior studies have provided evidence that Census indicators of neighborhood disadvantage are associated with worse mental and physical health (Leventhal and Brooks-Gunn, 2003; Beard et al., 2009; Johnson et al., 2012; Kravitz-Wirtz, 2016). However, a subset of households may have somewhat different experiences. Some residents of poor neighborhoods may experience elements of social connectedness that buffer against the negative aspects of disadvantaged neighborhoods. Studies have shown that both individual-level measures of social connectedness such as social ties (sometimes operationalized as neighborhood stability see Bures, 2003) and social support (see Bloom, 1990 for a review), as well as community-level measures such as social capital (Kawachi and Berkman, 2003), collective efficacy (Lei et al., 2018) and social cohesion (Morenoff, 2003; Kim et al., 2013) can be protective for health. However, other studies have found the social environment to affect health negatively through heightened stress (Boardman, 2004), exposure to disorder (Ross and Mirowsky, 2001), and experiences of discrimination (Schulz et al., 2000).

This study examines the heterogeneity of neighborhood life by assessing to what extent children who are socially connected to their neighborhoods, even if those neighborhoods are objectively disadvantaged, experience better physical and mental health outcomes as young adults. We utilize the Panel Study of Income Dynamics (PSID) core data (Panel Study of Income Dynamics, 2013) and the Childhood Development and Transition to Adulthood supplements to construct detailed, longitudinal accounts of individual, household, and neighborhood circumstances throughout childhood and early adulthood. The PSID is well-suited to address questions of how childhood neighborhood context and residential lived experiences combine to influence health over the life course, and our results contribute to a better understanding of the neighborhood-health relationship. The modeling of neighborhood selection is a novel contribution of our analysis. Because families self-select into neighborhoods, it is unclear whether families who are prone to worse health simply select into disadvantaged or less connected neighborhoods. To adjust for selection bias, we utilize inverse probability of treatment (IPT) weights.

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2. Background

Research has established that children of low socioeconomic status have worse health outcomes into adulthood (Galobardes 2004, 2008; Haas 2007; Cohen et al., 2010; Conroy et al., 2010). Furthermore, individuals living in high-poverty neighborhoods experience elevated rates of obesity (Burdette and Needham, 2012; Carroll-Scott et al., 2013), worse mental health (Caughy et al., 2003; Leventhal and Brooks-Gunn, 2003; Beard et al., 2009), have poorer self-rated health (Johnson et al., 2012; Kravitz-Wirtz, 2016), and increased mortality (Waitzman and Smith, 1998; Robbins and Webb, 2004). Thus, it appears both the trajectory of the individual's circumstances as well as the trajectories of neighborhood contexts over time matter for health (Clarke et al., 2014). Researchers who have incorporated aspects of residential histories into their models have found, for example, that longer durations and earlier timing of neighborhood poverty exposure are more detrimental to adult health (Power et al., 1999; Kravitz-Wirtz, 2016).

To explain such findings, the developmental perspective points to the ways in which early negative health experiences can affect biological systems, conditioning future health (Conroy et al., 2010; Taylor et al., 2011). On the other hand, drawing from cumulative inequality theory, childhood neighborhoods may offer favorable or unfavorable starting points that beget further advantages or disadvantages that amass over the life course (Ferraro and Shippee 2009; Vartanian and Houser 2010). Findings on the timing and duration of poverty exposure offer support for the cumulative inequality theory. Yet other research has pointed to the sensitivity of certain health outcomes to particular stages of development (Alvarado 2016a, 2016b; Brooks-Gunn et al., 1993; Leventhal and Brooks-Gunn, 2003), providing support for the critical period theory. More recently, a third model referred to as differential effects, diminished gains (Assari, 2018) or advantage leveling (Levy et al., 2019) has suggested that children from advantaged groups will be more vulnerable to disadvantaged contexts. All three lines of investigation reveal the need for further research on the role of childhood neighborhoods in adult health.

Another limitation of prior research is that it has not comprehensively explored variations in health outcomes *within* disadvantaged neighborhoods. In part, this is because prior research has often relied on Census-based measures of neighborhood disadvantage, failing to capture the wide range of experiences within these contexts. As a result, heterogeneity within disadvantaged neighborhoods is often underappreciated. This oversimplification masks a wide variety of social experiences within so-called disadvantaged communities. But are these variations meaningful for health?

2.1. Neighborhood disadvantage and health

Neighborhood disadvantage measures frequently consist of census tract indicators such as socioeconomic status, racial/ethnic composition, poverty rates, employment rates, rates of government assistance, education levels, and other sociodemographic variables (Sampson et al., 2008; Arcaya et al., 2016). Census indicators are commonly used because they are easily accessible, are collected at a smaller spatial scale than most other administrative data and capture some important aspects of the sociodemographic environment (Sharkey and Faber, 2014). Generally, Census indicators are thought of as proxies for more tangible aspects of the neighborhood that operate directly on health.

Studies measuring these neighborhood disadvantages directly or with Census proxies have yielded consistent evidence that structural neighborhood disadvantage affects many aspects of well-being across the life course (Waitzman and Smith, 1998; Robbins and Webb, 2004; Gordon-Larsen et al., 2006; Huang et al., 2018, 2020). Moreover, studies have shown that such Census-based measures of childhood neighborhood disadvantage are also predictive of adult health status (Sharkey and Elwert, 2011; Johnson et al., 2012; Alvarado, 2016b). From this and other evidence, researchers have inferred a cyclical process whereby children from disadvantaged neighborhoods are unable to escape poverty due to ongoing exposure to contextual disadvantages, rendering these children "stuck in place" (Sharkey and Elwert, 2011; Sharkey, 2013; Glass and Bilal, 2016).

2.2. Social connectedness and health

In recent years, scholars have recognized that not only is structural disadvantage unequally distributed across space, but so are social relationships (Small and Adler, 2019; Tóth et al., 2021). This has led researchers to examine the social context of neighborhoods as a significant predictor of health both proximally and over time. Studies on the social environment of neighborhoods and health have considered social support (see Bloom, 1990), social capital (Kawachi and Berkman, 2003; Wen et al., 2007), social cohesion (Kingsbury et al., 2020; Dawson et al., 2019), social networks (Wen et al., 2005), collective efficacy (Lei et al., 2018) and "social resources" (Wen et al., 2003) as possible mechanisms through which the social environment buffer poor health.

But many neighborhood and health researchers have utilized measures of neighborhood social connectedness. Scholars have generally described neighborhood social connectedness, also called neighborhood social integration or social ties, as social relationships with neighbors and neighborhood friends, neighborhood intergenerational closure, and sometimes community participation or connections to community institutions (Seeman, 1996; Lenzi et al., 2013; Erving and Hills, 2019). Social connectedness is often conceptualized as the converse of social isolation (Seeman, 1996). Existing evidence documents protective effects of social connectedness, including to neighborhoods, for the mental health of youth and young adults (Eugene 2021; Rose et al., 2019; Jose et al., 2012). The relationship between social connectedness and physical health shows more conflicting evidence. Some studies have found that neighborhood social connectedness is positively related to outdoor physical activity among children (Franzini et al., 2010), and therefore protective of childhood obesity (Franzini et al., 2009). Yet other research has reported that neighborhood connectedness in adolescence is not associated with BMI in young adulthood (Niu et al., 2019) and yet other studies have shown social networks to be associated with obesity among a sample of adults (Christakis and Fowler, 2007).

We can also potentially extend evidence from the closely related concept of neighborhood social cohesion (Forrest and Kearns, 2001). Similarly to studies of social connectedness, studies of social cohesion have found different effects by type of health outcome For example, one study found that perceived neighborhood cohesion was associated with better mental health and self-rated health, but also with increased obesity and binge drinking (Kim et al., 2020)With regards to mental health, such adolescent depression and anxiety (Kingsbury et al., 2020) and adult depression (Kim, 2010), social cohesion has been protective. And this relationship is even stronger in neighborhoods characterized by high levels of disadvantage (Dawson et al., 2019). However, the relationship between social cohesion and physical health is less clear. For example, in one study of adults, perceived neighborhood cohesion has been found to increase the risk of obesity (Martins et al., 2017) while other studies found social cohesion to be protective for heart health (Robinette et al., 2018) and stroke risk (Kim et al., 2013).

Furthermore, the effect of the neighborhood social environment on health likely interacts with other neighborhood qualities, but again, findings differ by health outcome. Some studies have reported that social connections and community engagement are particularly protective of mental health in neighborhoods characterized by high levels of disadvantage (Dawson et al., 2019; Hull et al., 2008). On the other hand, social resources appear to be more protective for self-rated health in neighborhoods with moderate or low disorder (Bjornstrom et al., 2013) and in more affluent neighborhoods (Browning and Cagney, 2003; Cagney et al., 2005).

2.2.1. Social connectedness, health and race

Several studies have also found variation in the effects of the social environment on health by sociodemographic characteristics such as gender (Wen et al., 2007; Guilcher et al., 2017), level of education (Cagney et al., 2005) age (Robinette et al., 2013), and race (Mujahid et al., 2017), Race has been a frequent focus in studies of neighborhoods and health due to the spatialized nature of racial health disparities (Gebreab and Diez Roux, 2012). Prior studies on race, space, and health suggest that various racial groups may interact with or experience the risks or resources of their neighborhoods differently. One explanation for these findings is the leveling of advantage (Levy et al., 2019) or differential gains theory (Assari 2018). Studies in this vein have shown that even when access to healthcare or exposure to risk factors is controlled for, health disparities remain (Yearby, 2018). The argument goes that due to the many levels and layers of racism in this country, the same environmental exposures will still produce differential effects (Krieger 1999; Brondolo et al., 2009).

2.3. Neighborhood selection

Self-selection into neighborhoods further complicates the specification of neighborhood effects on health. Sociodemographic characteristics such as family income, race, age, and education influence whether and where people move (South and Deane, 1993). This means that predictors of health, like race and income, also predict neighborhood context thus making it difficult to isolate the effect of neighborhood context on health. One method to address self-selection is to control for a host of sociodemographic characteristics (like race, income, and education) predictive of both neighborhood context and health. Yet this method known as "regression-adjustment" can be problematic, especially when confounding variables are present (Thoemmes and Ong 2016). In neighborhood studies, regression-adjustment often leads to underestimating neighborhood effects (Nandi et al., 2012). Increasingly, studies utilize novel methods that model (rather than control-away) selection processes to arrive at more accurate estimates of neighborhood effects on health (Do et al., 2013; Kravitz-Wirtz, 2016; Spring 2018). We utilize such methods to adjust for selection effects in the hypotheses outlined below.

2.4. Hypotheses

The objective of the proposed study is to assess how childhood neighborhood context, in terms of Census-based measures and residential lived experiences, influences physical and mental health outcomes in early adulthood. We anticipate that:

H1. Children growing up in disadvantaged neighborhoods, based on Census measures, have worse health outcomes as young adults, independent of selection effects.

H2. Children growing up in neighborhoods with higher levels of social connectedness have better health outcomes as young adults, independent of selection effects.

H3. Social connectedness moderates the effect of neighborhood disadvantage on health, such that neighborhood disadvantage is less related to health at higher levels of neighborhood social connectedness.

We also test these hypotheses separately by race, given differential neighborhood contexts as a result of racial residential segregation. Support for these hypotheses has several important implications. It would confirm the heterogeneity of experiences within disadvantaged neighborhoods. It would also help clarify the role of social connectedness for health across differing neighborhood contexts. Understanding the nuances of how disadvantaged neighborhoods are experienced by their residents can inform more targeted public health policies and interventions.

3. Methods

3.1. Data and measures

We relied on longitudinal panel data from the PSID, merged with neighborhood data from the U.S. Census Bureau. Our sample was selected from children who participated in the 1997 Child Development Supplement (sometimes referred to as CDS-I) *and* at least one year of the 2005–2017 Transition to Adulthood Supplement (TAS). The CDS-I sample consisted of 3563 children ages 0–12 whose parents were enrolled in the PSID, with up to two children selected per family. All PSID families were eligible and the response rate was 88% (PSID, 1997). The TAS began in 2005 and was designed to collect information from all children who had participated in the CDS who had turned age 18. The TAS collected information from respondents biennially until they reached age 28. By the 2015 wave of the TAS, all members of CDS-I cohort had reached adulthood and were eligible for at least one wave of the TAS. The response rate for eligible respondents ranged from 64 to 89% across TAS survey waves (PSID, 2017). We linked geo-codes for the sample individuals to Census data on their 1997 neighborhood, with neighborhoods being defined as the census tract. Of the 3563 children in the CDS-I cohort, we excluded 1330 children that did not have a CDS household questionnaire completed by the primary caregiver and 429 that did not participate in any TAS wave, resulting in a final sample of 1804 individuals. The analytic sample included 890 sibling pairs. Further information on the CDS and TAS supplements can be found in the CDS and TAS user guides on the PSID website.

3.1.1. Health in early adulthood

The main outcome of interest was health in early adulthood, utilizing both mental and physical health measures from the TAS. Mental health was measured with self-reported responses to the K-6 nonspecific psychological distress scale (Kessler et al., 2002). The scale has been validated as a screening tool for clinically significant mental distress (Kessler et al., 2003; Prochaska et al., 2012) and exhibits little bias with regard to sex and education (Baillie, 2005). We dichotomized the measure based on the previously established threshold of 13 or more as an indicator of serious distress (Kessler et al., 2003). The scale was measured at potentially multiple points in time since some respondents participated in up to six waves of the TAS. About 14% of our analytic sample participated in one wave, 22% in two waves, and 64% in three or more waves. We modeled whether respondents ever reached the threshold for serious distress over the observation period. We also analyzed average distress by calculating respondents' mean values on the scale over the observation period, but found that too few respondents (2%, n = 37) reached the threshold for serious distress to support analysis. We also think that ever seriously distressed is a useful measure because it accounts for young adults who sought treatment to lower their distress (and thus their overall mean) after a period of clinically significant distress.

Our physical health measure is obesity based on calculated BMI from height and weight measures that were collected by the interviewer. BMI was measured at potentially multiple points in time if respondents participated in more than one wave of the TAS. We calculated their mean BMI over the observation period, and then dichotomized this value based on World Health Organization (2021) thresholds so that an average BMI above 30 was classified as obese. We acknowledge there are significant limitations with BMI as a measure of physical health. At best, BMI is a screening tool for physical health, but it does not measure body fat directly and cannot diagnose the health of an individual (CDC, 2022). Obesity is correlated with chronic problems like asthma, hypertension, cardiovascular disease, and diabetes (Dixon, 2010), but it is unclear whether obesity is a direct cause of such disease or a risk factor. Other research suggests the correlation between obesity and chronic disease might be spurious, driven by their joint relationship with social determinants of health such as low income, unemployment, and food and housing insecurity (Medvedyuk et al., 2018; Offer et al., 2010). With BMI's limitations in mind, we conducted supplementary analyses based on the presence of chronic health conditions in early adulthood including asthma, cancer, diabetes, and high blood pressure, but found these had very weak associations with our neighborhood measures perhaps due to the infrequency of chronic conditions in our sample. We do not present results for chronic conditions here, but results are available upon request.

3.1.2. Neighborhood disadvantage in childhood

Building on prior work in this area (Wilson, 1987; Massey and Denton, 1993; Sampson et al., 2008), we conceptualized disadvantaged neighborhoods as areas subject to several reinforcing economic and social disadvantages. Following Sampson et al. (2008), we created a standardized index of five census tract characteristics representing the individual's neighborhood in 1997. These characteristics were percentage of families below the poverty line, percentage of unemployed residents in the civilian labor force, percentage of families receiving public assistance, percentage of female-headed households with children, and racial composition (percentage of residents who were Black) (Sampson et al., 2008). These five characteristics are highly correlated at the neighborhood level and summarized together, they reflect a more holistic measure of concentrated disadvantage than examining single items (Sampson et al., 2008).

3.1.3. Neighborhood social connectedness in childhood

We measured neighborhood social connectedness with a series of five questions from the CDS which we summarized into an index describing children's 1997 neighborhoods. These questions were asked of the child's primary caregiver, who was typically the mother but could also be the father or another legal guardian, who lived with and provided the majority of care for the child. Questions consisted of: How difficult is it for you to tell a stranger in your neighborhood from someone who is a resident? How many of the adults living in your neighborhood do you talk with regularly? How many children or teenagers living in your neighborhood do you know by name? Not counting family members who live with you, how many family members live in your neighborhood? How many good friends do you have that live in your neighborhood? We constructed a three-category variable for each question ranging from zero (low connectedness) to two (high connectedness). We then summed the values from the five variables to create one summary index of neighborhood connectedness, which ranged from 0 (no connectedness on any question) to 10 (high connectedness on every question). To ensure a robust index design, we created other indices including 1) a standardized index that averaged continuous measures of social connectedness and 2) a factor analysis index using continuous measures of social connectedness. Separate analysis revealed that all three indices were highly correlated (with each other and with individual items) and all were similarly related to length of residence and neighborhood poverty exposure (Author, 2021).

3.1.4. Covariates influencing neighborhood selection

We attempted to measure as many factors as possible that drive selection into childhood neighborhoods and may also influence subsequent health. Covariates were all measured in 1997, concurrently to the childhood neighborhood measures. Covariates included child's age and sex, household-level attributes including length of residence in the same home (less than 1 year, 1–3 years, 3–5 years, 5 years or more), household income (standardized to year 2000 dollars), number of children under 18 in the household, homeownership status, and residing in public housing. Additional covariates including employment status, race/ethnicity, and education level were not available for all members of the household, so we used the values of the household reference person (i.e., the person who responded to the family survey). And, because the health of household members could influence neighborhood selection, we included whether the child had a chronic health condition (i.e., asthma, diabetes, hypertension, cancer, psychiatric condition, and/or other) and whether the household reference person and/or spouse (if present) had fair/poor self-reported health. A small number of variables were missing values for some individuals. We utilized multiple imputation to fill in missing values, using all covariates and outcomes from our analysis as predictor variables, following White et al. (2011).

3.2. Analytic strategy

Our analysis proceeded in four steps. First, we calculated descriptive statistics for our study sample. Second, we modeled selection into childhood neighborhoods. To do so, we estimated separate OLS regressions predicting the disadvantage index and the social connectedness index for childhood neighborhoods. Predictors included all covariates listed above which we anticipated influenced neighborhood selection. Third, we used these same covariates to construct weights that we utilized to adjust for neighborhood selection in our fourth and final step: the modeling of neighborhood effects on health. The analyses were conducted using Stata/MP 17.0 (StataCorp LLC, College Station, TX).

The calculation of weights to adjust for neighborhood selection proceeded by modeling the respondent's neighborhood disadvantage index and their social connectedness index during childhood with their 1997 covariates. Respondents were then assigned a treatment weight for each neighborhood measure, following the process outlined by Thoemmes and Ong (2016) to calculate and stabilize weights for continuous treatment variables with treatment effects at one point in time. The final weight, called the inverse probability of treatment (IPT) weight, was the product of multiplying the stabilized neighborhood disadvantage weight with the stabilized neighborhood connectedness weight. For each individual, the resulting IPT weight captures the probability of being exposed to their specific levels of neighborhood disadvantage and neighborhood social connectedness. Compared to conventional regression, the IPT method better accounts for the confounding factors that predict receiving the neighborhood "treatment" without washing out the neighborhood's effects on our health outcomes of interest.

We then utilized the IPT weights as probability weights in the modeling of neighborhood effects on health. We estimated logistic models predicting psychological distress and obesity, first for the full analytic sample and then stratified by race. We estimated the unadjusted effects of neighborhood disadvantage and connectedness on the health outcome (utilizing no other covariates or weights) and then re-estimated applying the IPT weights. This allowed us to compare the size of neighborhood effects with and without adjustments for neighborhood selection. We then incorporated an interaction between neighborhood disadvantage and connectedness to assess whether there was a moderating effect. Results in the IPT-weighted models reflect the adjusted neighborhood effect with the 1997 covariates factored into the weighting; thus, it was unnecessary to include the 1997 covariates as controls in the models.

The race-stratified models are for non-Hispanic White ($n = 925$) and non-Hispanic Black ($n = 700$) respondents. We estimated both race-stratified and interaction models but present the stratified models because we felt they were easier to interpret than three-way interactions. We report the 90% confidence intervals for coefficients to help assess statistically significant difference between groups. We note several limitations to our racial analysis. First, race represents the race of the household reference person in 1997 and not the child/young adult whose outcomes we measure. Second, although they were included in the full sample analysis, the 179 respondents who identified as Hispanic/Latino (of any race), Asian, Native American, Pacific Islander, multi-racial, or another race/ethnicity were not analyzed separately due to their small sample size and the necessity of combining many different populations into one analytic category. Third, our results for White and Black respondents represent extremely broad categories and do not capture meaningful distinctions within these groups. Unfortunately, a more nuanced investigation of race was not possible with our data. In all models, we utilized standard errors clustered by family identification numbers to account for the non-independence of siblings in our data. We used a *p* threshold of .1 to determine statistical significance, rather than the more conventional 0.5, following suggestions that increasing the alpha level may be necessary when testing interactions within subgroups (Rouhani, 2014; Neergheen et al., 2019).

4. Results

4.1. Sample characteristics

Table 1 presents the descriptive statistics for our sample of 1804 individuals. In 1997, these individuals were children with an average age of 6.48 years. Most were exposed to relatively average levels of neighborhood disadvantage (based on the standardized index mean of 0.001 and standard deviation of 0.876), but some lived in levels of disadvantage that were more than 4 standard deviations above the mean. At the same time, the child's caregiver reported a level of neighborhood social connectedness that averaged 6.64 (out of a possible maximum of 10) on the connectedness index. The child's caregiver also reported the length of time their family had lived in the current home. Most families, about 43%, had lived in their current home for 5 or more years. About 17% had lived in their current home for 3–5 years, 24% for 1–3 years, and 15% for less than 1 year. Table 1 also reports socio-demographic factors in childhood, since factors like race, income, and education are likely to be important determinants of health and correlated with neighborhood context. The mean household income was roughly $50,000 a year with a minimum of $0 and a maximum of about $633,000. Almost 60% resided in owner-occupied homes and 83% of household reference persons were employed. Roughly a quarter of household reference persons did not complete high school, about 34% were high school graduates and about 20% had a college degree or higher.

The same children were observed again in early adulthood, sometime between 2005 and 2017. We are particularly interested in whether any children developed adverse health conditions in early adulthood. Table 1 shows that among young adults, 10% ever experienced serious psychological distress. Most young adults (49%) had a BMI within the normal range. About 3% were considered underweight, 28% overweight, and 20% obese.

Table 1
Summary of variables (n = 1804).

	Mean/ %	SD	Min	Max	N (Obsv)
Childhood Measures (1997)					
Neighborhood disadvantage index	.001	.876	−1.04	4.27	1799
Neighborhood connectedness index	6.64	2.45	0	10	1769
Consider neighborhood					1773
Block or street you live on	30.21%				
Block or streets and several streets	35.14%				
Area within 15 min walk	19.96%				
Area larger than 15 min walk	14.69%				
Length of residence					1804
Less than 1 year	15.35%				
From 1 to less than 3 years	24.33%				
From 3 to less than 5 years	17.07%				
5 or more years	43.24%				
Child's age	6.48	3.59	1	13	1804
Child's sex (1 = female)	49.94%				1804
Household income (in 000s)	50.16	49.41	0	633.61	1803
Number of children in household	2.33	1.11	1	8	1803
Owner occupied (1 = yes)	59.59%				1803
Public housing (1 = yes)	7.32%				1803
Household reference person currently employed (1 = yes)	82.65%				1802
Race/ethnicity of household reference person					1804
White	51.27%				
Black	38.80%				
Latino	6.49%				
Other (Native, Asian, multiracial and other)	3.44%				
Education of household reference person, highest level completed					1797
Less than high school	23.67%				
High school graduate	33.70%				
Some college	22.34%				
College graduate and postgraduate	20.29%				
Child has chronic health condition (1 = yes)	36.75%				1804
Household reference person or spouse in fair/poor health (1 = yes)	14.08%				1801
Young Adulthood Measures (2005–2017)					
Ever serious psychological distress (1 = yes)	9.92%				1804
Average BMI category					1800
Underweight	2.49%				
Normal	48.89%				
Overweight	28.22%				
Obese	20.40%				

Notes: First of 10 imputation datasets. N (Obsv) is the number of non-missing observations for each variable.

4.2. Selection into childhood neighborhoods

Our estimates of neighborhood effects on health outcomes are unbiased to the extent that we accurately modeled selection into childhood neighborhoods. In Table 2, we present the models of neighborhood selection that we used as the basis for constructing IPT weights. We estimated separate OLS models predicting the individual's neighborhood disadvantage score and connectedness score, with both outcomes sharing the same set of predictor variables. The modeling of neighborhood disadvantage shows that higher levels of disadvantage are associated with living in the neighborhood longer (5+ years as opposed to less than 1 year), having more children in the household, living in public housing, and having a non-white household reference person. Lower levels of disadvantage are expected with increases in household income, levels of education, and for households that own their home. The same factors do not necessarily predict connectedness. Length of residence is very important to connectedness, with greater levels of connectedness expected the longer a family has lived in the neighborhood. Greater connectedness is also expected for households that own their home as well as residents of public housing.

4.3. Neighborhood effects on mental and physical health

We now turn to exploring whether childhood neighborhood context predicts health outcomes in early adulthood. We begin by predicting psychological distress, measured as ever meeting a value of 13 on the K-6 scale. Table 3 reports the results. Model 1 shows the unadjusted neighborhood effects, whereas models 2 and 3 incorporate IPT weights that were constructed from the modeling of neighborhood selection reported in Table 2.

The unadjusted results indicate that higher levels of neighborhood disadvantage in childhood are associated with an increased risk of psychological distress in early adulthood. A one-point increase on the neighborhood disadvantage index results in a 31.2% increase in the odds of psychological distress. However, the risk of psychological distress is reduced by neighborhood social connectedness. Each one-point increase in connectedness reduces the odds of distress by 7.6%. Both

Table 2
OLS models of selection into neighborhood disadvantage and neighborhood social connectedness in childhood.

	Neighborhood disadvantage index (1997)			Neighborhood connectedness index (1997)		
	ß		*(se)*	*ß*		*(se)*
Childhood attributes (1997)						
Length of residence (ref = less than 1 yr)						
From 1 to less than 3 years	.047		(.064)	1.033	***	(.247)
From 3 to less than 5 years	.066		(.070)	1.364	***	(.263)
5 or more years	.148	*	(.059)	1.962	***	(.239)
Consider neighborhood (ref = block or street)						
Block or streets and several streets	−.055		(.046)	.049		(.171)
Area within 15 min walk	−.103	†	(.058)	.009		(.185)
Area larger than 15 min walk	−.053		(.060)	−.091		(.215)
Child's age	−.004		(.005)	.026		(.018)
Child's sex (1 = female)	−.002		(.029)	.038		(.112)
Household income[c] (in 000s)	−.002	***	(.0004)	−.0004		(.002)
Number of children in household	.067	**	(.020)	.096		(.062)
Owner occupied (1 = yes)	−.179	***	(.049)	.865	***	(.183)
Public housing (1 = yes)	.388	**	(.145)	.808	**	(.270)
Household reference person currently employed (1 = yes)	−.006		(.069)	−.223		(.212)
Race/Ethnicity of household reference person (ref = white)						
Black	.989	***	(.048)	−.033		(.174)
Latino	.708	***	(.084)	.251		(.317)
Other (Native, Asian, multiracial and other)	.509	***	(.121)	.375		(.392)
Education of household reference person, highest level completed (ref=< high school)						
High School graduate	−.133	*	(.061)	−.242		(.180)
Some College	−.146	*	(.061)	−.004		(.207)
College graduate and postgraduate	−.206	**	(.062)	.262		(.223)
Child has chronic health condition[d] (1 = yes)	.016		(.030)	.001		(.122)
Household reference person or spouse in fair/poor health (1 = yes)	−.065		(.058)	.057		(.209)
Constant	−.330	**	(.109)	4.506	***	(.394)
N of observations	1804			1804		

Note: Combined estimates from 10 multiple imputation datasets.
†p < .10, *p < .05, **p < .01, ***p < .001.

neighborhood effects are simple associations because they do not account for differential selection into neighborhoods. In Model 2, which incorporates the IPT weights, the effect of neighborhood disadvantage is significantly reduced and becomes non-significant. In other words, the association between neighborhood disadvantage and psychological distress may be driven by differential selection of people prone to distress into disadvantaged neighborhoods as opposed to a direct effect of neighborhood disadvantage on distress. Connectedness remains a significant predictor of lower distress even after adjusting for selection. Results in Model 2 show that a one-point increase on the connectedness index results in a 14% decrease in the odds of distress. Model 3 adds in the interaction between neighborhood disadvantage and social connectedness, but we do not find a significant interaction. In other words, neighborhood connectedness is similarly protective against psychological distress at all levels of neighborhood disadvantage.

We next explore whether childhood neighborhoods are related to obesity in early adulthood. Table 4 reports the results. Model 1 indicates that neighborhood disadvantage (but not neighborhood connectedness) in childhood is associated with an increased risk of obesity. For each one-unit increase on the disadvantage index, we expect a 21.8% increase in the odds of developing obesity. Model 2 incorporates the IPT weights and we find that the effect of neighborhood disadvantage is weakened but remains marginally significant. Obesity appears associated with neighborhood disadvantage partly, but not fully, due to selection effects. In all models, neighborhood connectedness is unrelated to obesity, even when we allow the effect of connectedness to vary by levels of neighborhood disadvantage.

4.4. *Differential effects by race*

While our previous analyses account for race as a confounding factor by including it in models for neighborhood selection, we have not yet considered whether the effect of neighborhoods on health could differ by race. Here, we re-estimate our models separately by race for those who are non-Hispanic White and non-Hispanic Black. Table 5 shows the race-stratified results for psychological distress. In Model 1, the baseline odds of psychological distress (as evidenced by the constant) are significantly below one for both Black and White respondents, but are not significantly different from each other (as evidenced by the overlapping confidence intervals). Model 1 also shows that neighborhood disadvantage significantly increases the risk of distress for both Black and White respondents, but again, we do not find that the effect differs by race. In Model 2, the effect of neighborhood disadvantage disappears for both groups, indicating the role of selection processes despite race. We do not find a protective effect of social connectedness in any model, unlike we did in the full sample. This could relate to reducing our sample into smaller groups, which may have diminished statistical power. While somewhat inconclusive, our race-stratified models for psychological distress fail to uncover pronounced racial differences.

Table 6 shows the race-stratified results for obesity. Model 1 shows that the baseline odds of being obese are less than one for both groups, and do not differ among Black and White respondents. In Model 1, an effect of neighborhood disadvantage on obesity is found only for White respondents. Each one-unit increase in neighborhood disadvantage results in an 87.6% increase in the odds of obesity among White young adults. This is significantly higher than for Black young adults, for whom the effect of neighborhood disadvantage in Model 1 is not statistically significantly and has a 90% confidence interval that does not overlap with White respondents. Model 1 also shows a protective effect of social connectedness for obesity among White young adults, but which is not

Table 3
Logistic estimates of the effect of childhood neighborhoods on ever psychologically distressed in early adulthood.

	Model 1: unadjusted neighborhood effect			Model 2: IPT-weighted neighborhood effect			Model 3: IPT-weighted neighborhood effect with interaction		
	or		*(se)*	*or*		*(se)*	*or*		*(se)*
Neighborhood attributes (1997)									
Disadvantage Index	1.312	***	(.101)	1.165		(.118)	1.509		(.452)
Social Connectedness Index	.924	*	(.030)	.860	*	(.062)	.861	*	(.063)
Disadvantage*Social Connectedness							.959		(.044)
Constant	.178	***	(.039)	.278	**	(.132)	.277	**	(.133)
N of observations	1804			1804			1804		

Note: Combined estimates from 10 multiple imputation datasets.
†p < .10, *p < .05, **p < .01, ***p < .001.

Table 4
Logistic regression estimates of the effect of childhood neighborhoods on obesity in early adulthood.

	Model 1: unadjusted neighborhood effect			Model 2: IPT-weighted neighborhood effect			Model 3: IPT-weighted neighborhood effect with interaction		
	or		*(se)*	*or*		*(se)*	*or*		*(se)*
Neighborhood attributes (1997)									
Disadvantage Index	1.218	**	(.077)	1.205	†	(.125)	.733		(.230)
Social Connectedness Index	.963		(.027)	.982		(.046)	.981		(.046)
Disadvantage*Social Connectedness							1.076		(.049)
Constant	.326	***	(.061)	.346	**	(.115)	.344	**	(.114)
N of observations	1804			1804			1804		

Note: Combined estimates from 10 multiple imputation datasets.
†p < .10, *p < .05, **p < .01, ***p < .001.

Table 5
Logistic estimates of the effect of childhood neighborhoods on ever psychologically distressed in early adulthood, by race white (n = 925).

	Model 1: unadjusted neighborhood effect				Model 2: IPT-weighted neighborhood effect				Model 3: IPT-weighted neighborhood effect with interaction			
	or		*(se)*	*90% CI*	*or*		*(se)*	*90% CI*	*or*		*(se)*	*90% CI*
Neighborhood attributes (1997)												
Disadvantage Index	1.643	*	(.381)	1.122–2.407	1.152		(.302)	.748–1.772	4.445		(4.841)	.736–26.843
Social Connectedness Index	.934		(.044)	.864–1.009	.917		(.061)	.821–1.023	.866		(.083)	.740–1.014
Disadvantage*Social Connectedness									.803		(.127)	.619–1.042
Constant	.194	***	(.069)	.108–.348	.193	**	(.098)	.083–.447	.259	*	(.162)	.093–.725
Black (n = 700)												
	Model 1: unadjusted neighborhood effect				Model 2: IPT-weighted neighborhood effect				Model 3: IPT-weighted neighborhood effect with interaction			
	or		*(se)*	*90% CI*	*or*		*(se)*	*90% CI*	*or*		*(se)*	*90% CI*
Neighborhood attributes (1997)												
Disadvantage Index	1.391	**	(.159)	1.153–1.679	1.260		(.191)	.981–1.617	.863		(.311)	.478–1.560
Social Connectedness Index	.919		(.051)	.839–1.007	.820		(.113)	.654–1.030	.808		(.120)	.632–1.032
Disadvantage*Social Connectedness									1.064		(.071)	.954–1.187
Constant	.165	***	(.061)	.090–.302	.338		(.284)	.085–1.345	.361		(.310)	.088–1.480

Note: Combined estimates from 10 multiple imputation datasets.
†p < .10, *p < .05, **p < .01, ***p < .001.

Table 6
Logistic regression estimates of the effect of childhood neighborhoods on average obesity in early adulthood, by race white (n = 925).

	Model 1: unadjusted neighborhood effect				Model 2: IPT-weighted neighborhood effect				Model 3: IPT-weighted neighborhood effect with interaction			
	or		*(se)*	*90% CI*	*or*		*(se)*	*90% CI*	*or*		*(se)*	*90% CI*
Neighborhood attributes (1997)												
Disadvantage Index	1.876	**	(.400)	1.322–2.664	1.621		(.486)	.989–2.656	1.391		(1.372)	.267–7.243
Social Connectedness Index	.914	*	(.035)	.858–.973	.963		(.058)	.872–1.064	.971		(.084)	.841–1.121
Disadvantage*Social Connectedness									1.029		(.169)	.781–1.355
Constant	.505	*	(.135)	.325–.784	.365	*	(.144)	.191–.697	.350	*	(.186)	.146–.843
Black (n = 700)												
	Model 1: unadjusted neighborhood effect				Model 2: IPT-weighted neighborhood effect				Model 3: IPT-weighted neighborhood effect with interaction			
	or		*(se)*	*90% CI*	*or*		*(se)*	*90% CI*	*or*		*(se)*	*90% CI*
Neighborhood attributes (1997)												
Disadvantage Index	.924		(.093)	.783–1.090	1.032		(.143)	.822–1.295	.391	*	(.173)	.189–.810
Social Connectedness Index	1.043		(.046)	.970–1.120	1.012		(.079)	.888–1.153	.995		(.082)	.867–1.141
Disadvantage*Social Connectedness									1.151	*	(.074)	1.035–1.279
Constant	.270	***	(.080)	.164–.440	.342	†	(.188)	.137–.857	.369	†	(.206)	.145–.936

Note: Combined estimates from 10 multiple imputation datasets.
†p < .10, *p < .05, **p < .01, ***p < .001.

significantly different than from Black young adults. In Model 2, the effect of neighborhood disadvantage on obesity disappears for White respondents and becomes similar to Black respondents, indicating the role of selection processes for White respondents.

In Model 3, an interaction between neighborhood disadvantage and connectedness is found among Black respondents such that the effect of connectedness increases as disadvantage increases and vice versa. Moreover, at high levels of disadvantage connectedness is a risk factor for obesity, such that higher levels of connectedness predict increased odds of obesity. The neighborhood effects are significantly above zero for Black respondents, but inconclusive for White respondents. The overlapping confidence intervals suggest that the effects for White respondents could be equivalent to Black respondents. But, the large standard errors for White respondents, particularly for the disadvantage coefficient, suggests the White estimates are very imprecise. This might relate to having few White respondents at high levels of neighborhood disadvantage, as we do find that the group mean on the standardized disadvantage index differs substantially among Black and White respondents (Black mean = .666; White mean = −0.546). Although deeper investigation is necessary, the race-stratified results for obesity suggest that the combination of neighborhood disadvantage and connectedness is a risk factor for obesity for Black young adults, and possibly also White young adults.

5. Discussion

This study set out to incorporate both Census-based measures of structural neighborhood disadvantage and subjective measures of neighborhood social connectedness, to examine whether and to what extent these neighborhood attributes influence health. Although exposure to neighborhood disadvantage in childhood has been linked to a range of deleterious health outcomes in early adulthood, lived experiences in such neighborhoods may differ, tempering this effect. Census measures in our study are predictably associated with health but remain an imprecise measure because they constitute many different processes. Our study attempted to parse out effects due to selection and effects due to connectedness. We do not find evidence of a robust relationship between childhood neighborhood disadvantage and early adult health after adjusting for self-selection into neighborhoods. However, adjusting for self-selection helps reveal conflicting associations between neighborhood social connectedness and mental and physical health. Our findings indicate that neighborhood connectedness in childhood is protective against psychological distress in early adulthood. However, greater connectedness may exacerbate the risk of obesity.

Further analysis reveals that relationships between neighborhoods and health may be conditional on race. We found no significant neighborhood effects on the health of White individuals after adjusting for self-selection into neighborhoods. Among Black individuals, we found a robust relationship between neighborhood social connectedness and the risk of obesity. Greater neighborhood connectedness was not only associated with a greater risk of obesity, but it also exacerbated the effect of neighborhood disadvantage. Black individuals growing up in structurally disadvantaged but socially integrated neighborhoods had the greatest risk of obesity. However, we were unable to pinpoint racial disparities in these neighborhood effects. Corollary results for White individuals were inconclusive, which we suspect relates to vast differences in the neighborhood environments of Black and White members of our sample.

There are several possible explanations for our conflicting findings regarding neighborhood social connectedness and its effect on mental versus physical health indicators. Prior literature on social connectedness and related concepts does point to a “dark side” (Portes, 1998) of our social networks. Theoretically, this suggests that all kinds of norms can be shared across a network, including ones that are detrimental to health. When this is coupled with the network being located in a resource-poor area, the risks of health behaviors also have less chance of mitigation. Attempting to capture this heterogeneity statistically is challenging as it lends itself to mixed effects or effects getting washed out. However, as attempted in this paper, refining not only the indicators and analytic tools but also the scale and frame can help to clarify under what conditions neighborhoods matter and for whom (Sharkey and Faber, 2014). This is reflected in our findings that connectedness operated differently for mental health, where it did appear to be largely protective, as opposed to obesity, where it functioned as a risk factor for Black respondents. This also lends support to the notion that neighborhood social integration operates as a double-edged sword. However, social connectedness was most detrimental for obesity *within the context of structural disadvantage*. Thus, our findings also lend support to the stuck in place perspective and conditionally for the theories of differential effects or advantage leveling. In sum, structural barriers can be so concentrated and robust that the effects are beyond compensation by individual-level resources.

We find limited evidence of differential neighborhood effects by race, but limitations with our data point to the need for deeper investigation. It is clear in our sample that average White and Black neighborhoods differ in the exposure to both resources and risk factors for residents. Legacies of racial discrimination and segregation have produced such vastly different neighborhood contexts for Black and White families that it may be unrealistic to draw comparisons using measurements and estimation models that have not been calibrated to each group. This idea aligns with recent calls to explore intragroup diversity within health outcomes rather than focusing on racial group comparisons (Cavalhieri and Wilcox, 2022; Amuta-Jimenez et al., 2020). Doing so can help us understand how race, as a socially-constructed rather than biological category, operates as a proxy for the differential risks and experiences associated with diverse groups in this country (Sewell 2016). A deeper investigation of race can also guide policymakers towards solutions that move beyond notions of equal access to a focus on equitable outcomes accomplished through multilevel interventions (Agurs-Collins et al., 2019).

6. Conclusion

This paper addressed the heterogeneity of experience by asking whether children in poor neighborhoods with high social connectedness experienced different health outcomes later in life than children in poor neighborhoods with low social connectedness. Furthermore, our study utilized novel statistical methods to better account for neighborhood selection, allowing for more precise estimates of neighborhood effects on health. We found that childhood levels of neighborhood social connectedness do indeed buffer mental health outcomes among young adults. However, social connectedness increases the risk of later in life obesity for Black children from impoverished neighborhoods. Results were inconclusive for White children. Our study does have some important limitations. First, our sample is not very racially representative. Unfortunately, the small numbers of individuals in our sample prohibited us from analyzing other racial/ethnic groups or describing nuances within Black and White populations. Second, our childhood neighborhood measures represent a single point in time, even though timing and duration of childhood exposures to neighborhood attributes are also likely important for subsequent health. There are also valid criticisms about the use of BMI as an indicator of health, particularly for Black women (Strings 2019). Future research should take on these challenging issues by embracing multiple approaches, including longitudinal analysis that can further clarify causal pathways, and qualitative analysis that can add greater nuance and deeper insight into neighborhood and community life.

Data availability

Data will be made available on request.

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