EFFECTS OF GROWING UP IN SEPARATE AND UNEQUAL NEIGHBORHOODS ON RACIAL DISPARITIES IN OBESITY IN EARLY ADULTHOOD

Extended Abstract

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Evidence suggests that residents of socioeconomically disadvantaged neighborhoods are at increased risk for obesity. Yet most research relies on cross-sectional data, which implicitly ignores continuity and change in the residential conditions individuals experience over time. Using the 1970-2011 waves of the Panel Study of Income Dynamics merged with census data on respondents' neighborhoods, this study estimates marginal structural models with inverse-probability-of-treatment and censoring weights to investigate the effects of duration and timing of exposure to neighborhood disadvantage from birth through age 17 on obesity incidence in early adulthood. Findings reveal that prolonged exposure to neighborhood disadvantage throughout childhood and adolescence is strikingly more common among nonwhites than whites and is associated with significantly greater odds of being obese at least once between ages 18 and 30. Moreover, exposure to neighborhood-level deprivation during adolescence appears more consequential for future (young adult) obesity than exposures that occur earlier in childhood.

INTRODUCTION

There is significant variation among neighborhoods in rates of obesity, defined in adulthood as having a body mass index (BMI) greater than or equal to 30 kg/m^2. Prior evidence suggests that residents of under-resourced neighborhoods characterized by the relative absence of healthy food stores, a preponderance of fast food and alcohol outlets, and systemic constraints on physical activity and social interaction tend to have higher BMI [1-9]. In addition, numerous studies have documented that exposure to neighborhood disadvantage is unequally distributed both in the population and across the life course. African Americans, in particular, are not only more likely than statistically comparable whites to ever reside in areas characterized by high levels of social and structural adversity, but they are also more likely to do so for repeated or prolonged periods of time [10-22]. These findings point to the importance in neighborhood effects research of characterizing if as well as when and for how long residential exposures occur, especially when assessing their contribution to racial disparities in overweight/obesity and other health-related outcomes. Until recently, however, the majority of scholarship in this area measured neighborhood characteristics only once or over just a short window of observation, conflating persons who were recently exposed with those who have (and in the case of some groups, are more likely to have) experienced more sustained residential adversity [23]. Such a conceptualization is inconsistent with most theories of neighborhood effects, which tend to specify mechanisms that are sensitive to the duration and timing exposure [17, 18, 24-27], as well as with a life course perspective in which experiences earlier in life are posited to have formative and enduring impacts on future outcomes, even when controlling for more contemporaneous determinants [28, 29].

Using the 1970 to 2011 waves of the Panel Study of Income Dynamics (PSID) merged with census data on respondents' neighborhoods, this study estimates marginal structural models with inverse probability of treatment and censoring weights to investigate the effects of duration and timing of exposure to varying levels of neighborhood disadvantage from birth through age 17 on obesity incidence in early adulthood (ages 18-30). To capture both continuity and change in residential exposures throughout childhood and adolescence – children and youth can move in and out of different neighborhoods or remain in areas that may or may not change around them – levels of neighborhood disadvantage are characterized once per year, every year during this time. In addition, by employing statistical methods that account for selection bias without controlling away neighborhood effects that may operate indirectly through the same individual-level covariates that have been associated with residential mobility, this study provides a more comprehensive assessment of the effects on

young adult BMI of exposures to neighborhood disadvantage that occur during different stages of development and accrue across the entire child and adolescent life course.

DATA AND METHODS

The analytic sample for this study consists of the 4,523 individuals born into PSID family units between 1970 and 1980.[1] Restricting the sample in this manner ensures that respondents are old enough to have been included in the survey from birth through young adulthood. Given the focus on the duration and timing of exposure to adverse neighborhood conditions throughout the entire child and adolescent life course, respondents are dropped if they are not continuously present for every year from ages zero to 17 or if they do not respond to any questions about height and weight in young adulthood. The final sample includes 1,522 individuals: 524 are classified as nonwhite, of which over 95 percent are African American, and 998 are classified as white.

Census tracts are used to approximate residential boundaries and data from the 1970 through 2000 decennial censuses are derived from the Neighborhood Change Database. Values for intercensal years are imputed using linear interpolation. Principal components analysis is used to generate a summary score of neighborhood disadvantage based on census tract poverty; unemployment; public assistance receipt; female-headed households; and educational (low and high) and occupational structure. These scores are then divided into quintiles ranging from the least (level 1) to the most (level 5) disadvantaged neighborhoods based on the distribution of all tract-year observations between 1970 and 2000. This information is merged with individual-level data in the PSID such that each respondent receives 18 different measurements of the level of disadvantage to which they were exposed, one for every year from birth to age 17. The average of these measurements during early childhood (ages 1-5), late childhood (ages 6-11), and adolescence (ages 12-17) or from ages one through 17 represents respondents' "duration-weighted" exposure to neighborhood disadvantage during distinct developmental periods or cumulatively throughout childhood and adolescence (disadvantage at birth is not included in the average but rather as part of a vector of baseline covariates).

[1] Sample members were asked for their year of birth at multiple survey waves. To address potential discrepancies in individual responses across waves, year of birth was determined as the modal response. For the few cases in which respondents never answered the year of birth question but did respond to question(s) about their age, age was used to determine their year of birth (i.e., interview year minus age at interview). Again, if this approach produced discrepancies across waves, the modal response was used. There were only 110 of 73,251 (<1%) respondents in the total PSID sample for whom year of birth could not be determined via the methods described above.

Because time-varying, individual-level covariates, such as parental income and employment, are associated with both BMI and selection into future neighborhoods and are themselves influenced by past neighborhoods, they are simultaneously confounders for the effects of future exposures and mediators for the effect of past exposures to neighborhood disadvantage [24, 34]. To account for such dynamic relationships, this study specifies marginal structural logistic regression models in which the parameters are estimated using inverse-probability-of-treatment and censoring weights. Intuitively, these weights create a "pseudo-population" in which randomization across the different levels of neighborhood disadvantage is simulated at each year by giving proportionally more (or less) weight to those respondents whose prior time-varying covariates are underrepresented (or overrepresented) in the neighborhood disadvantage quintile to which they are actually exposed at that age. In this way, exposure to different levels of neighborhood disadvantage at each year is independent of respondents' prior time-varying covariates, thereby avoiding the problem of differential selection (or attrition) based on such variables while still allowing them both to be affected by prior neighborhood conditions and to affect future covariates and subsequent BMI.

The final marginal structural logistic regression models estimating the effects of time-sensitive or prolonged exposure to neighborhood disadvantage during childhood and adolescence on the probability of being obese at least once between ages 18 and 30 is fit to the "pseudo-population" just described. Controlling for time-varying covariates is no longer necessary since their confounding effects on neighborhood selection have already been accounted for through the weighting process. However, baseline or time-invariant covariates are still included as controls in the final model.

RESULTS

Table 1 reveals striking inequalities in exposure to neighborhood disadvantage by race and age (mid-point of each of the three developmental stages), consistent with prior research. At age nine, for example, 70 percent of nonwhite children resided in the most disadvantaged neighborhood quintile compared to just 12 percent of whites. At the other end of the spectrum, only three percent of nonwhite versus 20 percent of white nine-year-olds resided in neighborhoods characterized by the least disadvantage. This same general pattern of racial-spatial inequality is also apparent at age three and age 15.

Table 1. Exposure to neighborhood (NH) disadvantage by race and age

	Total (n=1,522)			Nonwhite (n=524)			White (n=998)		
	Age 3	Age 9	Age 15	Age 3	Age 9	Age 15	Age 3	Age 9	Age 15
NH disadvantage quintile, percent									
1st quintile (least disadvantaged)	11.63	13.99	17.28	2.48	3.05	5.15	16.43	19.74	23.65
2nd quintile	14.13	13.67	16.16	3.24	4.77	6.68	19.84	18.34	21.14
3rd quintile	17.67	18.73	19.97	7.25	5.92	8.78	23.15	25.45	25.85
4th quintile	22.93	21.48	20.17	16.41	16.41	18.70	26.35	24.15	20.94
5th quintile (most disadvantaged)	33.64	32.13	26.41	70.61	69.85	60.69	14.23	12.32	8.42

Note: Statistics reported for respondents not lost to follow-up before age 18 and who answered at least one set of questions about height and weight in early adulthood (first of 10 imputation datasets).

The top panel of Table 2 shows results from the marginal structural logistic regression model with inverse-probability-of-treatment and censoring weights estimating the relationship between duration of exposure to neighborhood disadvantage throughout childhood and adolescence and obesity in early adulthood. Each unit (or quintile) increase in cumulative exposure to neighborhood disadvantage from ages one through 17 is related to a 37 percent increase in the odds of being obese at least once between ages 18 and 30, controlling for individual and familial covariates. The bottom panel of Table 2 compares the effects of timing of exposure between early childhood, late childhood, and adolescence. In notable contrast to research showing that family-level poverty in early childhood has a more influential effect on the first incidence of obesity than exposure during later years [35], these results suggest that exposure to neighborhood disadvantage during adolescence has a more consequential effect on obesity incidence in early adulthood than exposures that occur during early or late childhood.

Table 2. Effects of prolonged and time-sensitive exposures to neighborhood (NH) disadvantage on obesity (n=1,522)

	OR	P-value	95% CI
Duration of NH Disadvantage			
Avg. between ages 1-17	**1.37**	**0.003**	**1.12-1.68**
Timing of NH Disadvantage			
Avg. between ages 1-5	0.94	0.684	0.69-1.30
Avg. between ages 6-11	0.99	0.949	0.74-1.29
Avg. between ages 12-17	**1.37**	**0.001**	**1.13-1.67**

Notes: Statistics reported for respondents not lost to follow-up before age 18 and who answered at least one set of questions about height and weight in early adulthood; Coefficients are combined estimates from 10 multiple imputation datasets

DISCUSSION AND CONCLUSIONS

This study is among the first to examine the temporal dimensions of the neighborhood-obesity relationship using individual and neighborhood data from birth through early adulthood. The greater likelihood for nonwhite,

predominately African American, children to be born into and remain in neighborhoods characterized by socioeconomic deprivation in conjunction with the association between cumulative exposure to neighborhood disadvantage and obesity adds support to the growing body of literature suggesting that investing in the social, economic, institutional, and physical structures of under-resourced communities and communities of color can have long-term benefits for population health and health equity. Moreover, neighborhood-based interventions targeting the food and physical activity structures and behaviors of adolescents may be particularly successful in curbing the rising tide of obesity and obesity-related conditions (e.g., heart disease, stroke, type 2 diabetes, and certain cancers) among adults in the United States. More generally, this work offers more nuanced insights into when and how neighborhood exposures earlier in life affect health-related trajectories in ways that are eclipsed if neighborhoods are measured only once or over just a short time period.

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