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Temporal Effects of Child and Adolescent Exposure to Neighborhood Disadvantage on Black/White Disparities in Young Adult Obesity

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Abstract

Purpose—This study investigates the effects of duration and timing of exposure to neighborhood disadvantage from birth through age 17 on obesity incidence in early adulthood, as well as black/white disparities therein.

Methods—Individual- and household-level data from the 1970 to 2011 waves of the Panel Study of Income Dynamics are merged with census data on respondents' neighborhoods (n=1,498). Marginal structural models with inverse-probability-of-treatment and censoring weights are used to quantify the probability of being obese at least once between ages 18 and 30 as a function of average exposure to neighborhood disadvantage throughout childhood and adolescence or during each of three developmental stages therein.

Results—Longer-term exposure to neighborhood disadvantage from ages zero to 17 is more common among blacks than whites and is associated with significantly greater odds of being obese at least once in early adulthood. Exposure to neighborhood-level deprivation during adolescence (ages 10-17) appears more consequential for future (young adult) obesity than exposure that occurs earlier in childhood.

Conclusions—The duration and timing of exposure to neighborhood disadvantage during childhood and adolescence are associated with obesity incidence in early adulthood for both blacks and whites. However, given inequalities in the likelihood and persistence of experiencing neighborhood disadvantage as children and youth, such adverse effects are likely to be more concentrated among black versus white young adults.

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Implications and Contribution

Experiencing neighborhood adversity throughout childhood and adolescence, and in particular from ages 10 to 17, increases obesity risk in early adulthood. Ongoing and developmentally-appropriate investments 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.

The increased prevalence and associated health consequences of obesity have been called among the most burdensome public health issues facing the nation today [1]. Although interventions targeting individual dietary and exercise habits retain popular appeal, there is growing consensus among public health stakeholders that understanding and addressing obesity, as well as racial disparities therein, requires attention to factors in the broader environment [2, 3]. Prior evidence suggests, for example, 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 body mass index (BMI) [4-11]. Numerous studies further document that exposure to disadvantaged neighborhoods is unequally distributed both in the population and across the lifecourse. 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 also more likely to do so for prolonged periods of time [12-16].

These findings point to the importance in neighborhood effects research of characterizing if, as well as when and for how long, residential exposures occur. For instance, persistent exposure may be necessary for young people to learn the skills associated with and to internalize preferences for healthier food and more active lifestyles [17]. In addition, there is research to suggest that the increasing desire for autonomy and expanding social interactions during the adolescent stage of the lifecourse may make it a sensitive period for the development of obesity [18-21], as well as for the effects of neighborhoods on health-related outcomes more generally [22]. 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 experienced residential adversity for sustained or during developmentally sensitive periods [23].

Such a conceptualization is inconsistent with most theories of neighborhood effects, which tend to specify mechanisms that are affected by the duration and timing of exposure [14, 24, 25], as well as with a lifecourse 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 [26]. The reliance on largely cross-sectional data has made it particularly difficult to account for the evolving and interrelated nature of individual and neighborhood characteristics over time, as well as for the movement of individuals who already have physically active lifestyles and healthy diets into neighborhoods with characteristics that support such behaviors. The small but developing body of longitudinal research in this area suggests that children and youth, particularly girls and young women of color, who experience more disadvantaged circumstances not only have higher BMI at baseline, but also gain body mass at a faster rate over time compared to their more affluent counterparts [21, 27-30]. While these studies typically assess respondents' weights and heights at several points over the life course, they tend to measure neighborhood characteristics along with individual-level control variables at only one time point, usually the start of data collection or respondents' year of birth, or ignore time-varying confounding when such variables are measured repeatedly. As a result, the development and implementation of associated health promotion interventions continues to be hampered by

challenges to causal inference and most large-scale efforts still focus on the characteristics of people rather than the characteristics of places.

This study uses the 1970 to 2011 waves of the Panel Study of Income Dynamics (PSID) merged with census data on respondents' neighborhoods to investigate the effects of duration and timing of exposure to neighborhood disadvantage from birth through age 17 on obesity incidence in early adulthood, as well as black/white disparities therein. It employs a statistical approach that explicitly accounts for time-varying phenomena, allowing individual- and household-level characteristics to moderate the relationship between neighborhoods and BMI while also adjusting for potential confounding due to neighborhood selection bias at each wave of data collection. Findings, therefore, provide among the strongest evidence to date for the adverse effects on young adult obesity of more prolonged exposure to neighborhood disadvantage throughout the child and adolescent lifecourse, as well as for the sensitivity of such effects to the developmental timing of exposure.

Methods

The PSID is a longitudinal survey of US residents and their families conducted annually between 1968 and 1997 and every two years thereafter. The analytic sample for this study consists of the 4,334 black and white individuals born into PSID family units between 1970 and 1980. Respondents were dropped if they were not continuously present for every year from ages zero to 17 or if they did not respond to any questions about weight and height in young adulthood, leaving 1,498 individuals. Final sample members were more likely to be white, female, to be born to a married, slightly older mother, and into a household in which the head had attended at least some college. Adjustment for nonrandom attrition using censoring weights is discussed below.

Dependent Variable

Obesity is determined using self-reported weight and height to calculate BMI, the ratio of weight in kilograms (kg) to height in meters squared (m^2). Previous research shows a strong correlation between self-reported and directly measured weight and height and no significant differences in reporting across gender or race/ethnicity [31, 32]. Given this study's focus on obesity incidence in young adulthood, the outcome of interest is any report of weight and height amounting to a BMI greater than or equal to $30 \text{ kg}/m^2$ between ages 18 and 30.¹

Independent Variable

Similar to most research in this area, census tracts are used to approximate neighborhood boundaries. Despite limitations to this operational definition [cf. 33], there is broad consensus that census data at the tract level not only provide convenient access to considerable information over extensive time periods, but also serve as a reasonable proxy for, or are at least highly correlated with, the causally relevant definition of a neighborhood [34, 35]. The measure of neighborhood disadvantage is based on the following census tract

¹A combined measure of overweight/obesity ($BMI \geq 25 \text{ kg}/m^2$) was also examined with similar results, although statistical significance was often attenuated. Results examining BMI as a continuous measure (average BMI between ages 18-30) were consistent with those presented for obesity.

items derived from the Neighborhood Change Database (NCDB) [36] over the period 1970 to 2000²: (1) proportion of residents below the poverty line; (2) proportion of residents in the civilian labor force and unemployed; (3) proportion of households with public assistance income; (4) proportion of households with children that are female-headed; (5) proportion of residents with less than a high school diploma; (6) proportion of residents with a bachelors or graduate/professional degree; and (7) proportion of residents employed in managerial or professional/technical occupations.

Using principal components analysis (PCA), these seven items are combined to generate a composite index of neighborhood disadvantage. Specifically, the results of PCA produce a set of factor loadings for each item for each principal component. Using the factor loadings from the first principal component as weights, a neighborhood disadvantage score is then constructed for each census tract (or neighborhood) at every year between 1970 and 2000. The neighborhood disadvantage scores are then divided into quintiles ranging from the least (level 1) to the most (level 5) disadvantaged based on the distribution of all tract-year scores derived from the NCDB between 1970 and 2000, and subsequently merged with individual-level data on PSID respondents using the PSID's supplemental, restricted-use Geocode Match Files. Procedures were approved by the University of Washington's Institutional Review Board and through contractual agreement with the University of Michigan.

For the duration component of the analysis, a cumulative measure of exposure to neighborhood disadvantage throughout childhood and adolescence is calculated as the average of all the neighborhood disadvantage quintiles to which respondents were exposed from ages one through 17. Likewise, for the timing component, three separate measures of timing-specific exposure to neighborhood disadvantage during early childhood, late childhood, and adolescence are calculated as the average of all neighborhood disadvantage quintiles experienced by respondents from ages one to five, ages six to 11, and ages 12 to 17, respectively. Neighborhood disadvantage at birth is not included in these calculations but rather as part of a vector of time-invariant covariates.

Covariates

Individual- and household-level variables are included in analyses as either time-invariant or time-varying. Time-invariant covariates include a respondent's race, gender, birthweight, mother's age at birth, mother's marital status at birth, and household head's educational attainment at birth. Time-varying covariates, measured for every respondent at each wave between ages zero and 17, include household head's marital status, employment status, and work hours, as well as family size, homeownership, public assistance receipt, and total household income, standardized using the Consumer Price Index to 1985 dollars.

²The NCDB ensures that census data for all four decades has been normalized to 2000 tract boundaries and can therefore be compared across years without having to adjust for potential changes in boundary definitions over time. Data for intercensal years are imputed using linear interpolation. If data in 1970 and/or 1980 was missing (likely due to as yet untraced areas) and linear interpolation was impossible, data from 1980, 1990, and/or 2000 was used to extrapolate values for up to five years prior to the most recent value (e.g., if data in 1970 was missing, the linear interpolation from 1980 to 1990 was extended to 1975).

Statistical Analysis

Analyses employ marginal structural logistic regression models for the probability of being obese at least once in early adulthood as a function of (1) average exposure to neighborhood disadvantage throughout childhood and adolescence or during each of three developmental stages therein, and (2) time-invariant covariates. Adjustment for time-varying covariates is achieved through the use of inverse-probability-of-treatment (IPT) weights. This approach and its utility for longitudinal neighborhood effects research have been described in detail elsewhere [24, 37]. In brief, the IPT weights are derived by using a respondent's neighborhood conditions in the prior year, time-invariant covariates, and both prior year and concurrent time-varying covariates to predict their probability of exposure to their actual (observed) level of neighborhood disadvantage in subsequent years. The inverse of this predicted probability is used to weight each respondents' contribution to a pseudo-population in which time-varying covariates are balanced in expectation across the five levels of neighborhood disadvantage.³ Obesity incidence in young adulthood can then be regressed on either cumulative or timing-specific measures of exposure to neighborhood disadvantage using a conventional logistic regression model that does not include the time-varying covariates as controls.

Missing Data and Sample Attrition

Missing data on all independent variables are multiply imputed using the two-fold fully conditional specification algorithm [38]. The two-fold approach imputes missing values using chained equations at each time point conditional on information at the same time point plus or minus user-specified adjacent time points. This study employs the two years before and after any missing values for the imputation based on the assumption that measurements taken outside this window are unlikely to provide substantial additional information and may result in over-fitting. Due to computational constraints, only the neighborhood disadvantage scores rather than the individual census tract items are imputed.

To minimize the effects of biasing attrition, censoring weights for each respondent at each year are generated in the same manner as the IPT weights described above, except now the weights model the probability of remaining in the study for each respondent at each year, conditional on the same covariates as before. The pseudo-population to which the final logistic regression models are fit is actually constructed based on the product of the IPT and censoring weights for each respondent.

Results

Tables 1 and 2 present descriptive statistics for the time-invariant and time-varying sample characteristics, respectively, for the total sample as well as separately for black and white respondents.

³In practice, IPT weights can be highly variable. To increase efficiency and obtain narrower confidence intervals around the subsequent neighborhood effect estimate, the IPT weights for each respondent at each year are stabilized by multiplying each one by the same probability as was used to generate it, except only baseline covariates and prior year neighborhood conditions are included as regressors (i.e., time-varying covariates are excluded).

Temporal Patterns of Exposure to Neighborhood Disadvantage

Figure 1 illustrates overall and race-specific patterns of exposure to neighborhood disadvantage throughout the entire child and adolescent lifecourse, as well as separately for early childhood, late childhood, and adolescence. Higher values indicate more prolonged exposure to neighborhood disadvantage. The mean level of neighborhood disadvantage to which respondents, irrespective of race, are exposed throughout childhood and adolescence is 3.40, on average – that is, children and youth tend to be exposed to neighborhoods that fall between the third and fourth quintiles of the disadvantage distribution. This value is in the same general range during each of the three developmental stages, although it is slightly smaller during adolescence (mean=3.26).

When the total sample is stratified by race, the mean level of exposure to neighborhood disadvantage from ages one through 17 is 4.45 among black respondents compared to just 2.88 among white respondents. This suggests that while a considerable share of black respondents reside, on average, in the most disadvantaged neighborhoods, their white counterparts tend to experience neighborhoods characterized by significantly less deprivation. Again, the same general pattern of inequality in exposure to neighborhood disadvantage emerges during all three developmental stages for black versus white respondents.

Cumulative and Timing-Specific Neighborhood Effects on Obesity

Table 3 displays coefficients from an unadjusted logistic regression model (Model 1) examining the effect of race on obesity incidence, as well as from marginal structural models using IPT and censoring weights to estimate the effects of duration (Model 2) and timing (Models 3-6) of exposure to neighborhood disadvantage. Model 1 merely quantifies the statistically significant disparity in the probability of being obese at least once between ages 18 and 30 among black versus white respondents, without considering prior neighborhood exposures or individual- and household-level covariates. This unadjusted estimate indicates that black respondents have over two times greater odds of being obese at least once in early adulthood compared to white respondents.

Model 2 adds a measure of cumulative exposure to neighborhood disadvantage and uses IPT and censoring weights to account for the dynamic role of time-varying individual- and household-level covariates while also controlling for time-invariant characteristics. It is worth noting the statistical non-significance of the gender variable in this and all subsequent models. Whereas prior research has often found stronger effects of childhood disadvantage on future BMI for females versus males [28, 30], much of this work has examined family- rather than neighborhood-level disadvantage and, consistent with the current findings, socioeconomic indicators at the neighborhood level more often show effects for both females and males [28]. Moreover, this second model shows that race is no longer a statistically significant predictor of obesity incidence. Rather, each unit (or quintile) increase in cumulative exposure to neighborhood disadvantage from ages one through 17 is related to a statistically significant 37% increase in the odds of obesity incidence in early adulthood. By computational extension, respondents who were persistently exposed to neighborhoods in the most disadvantaged quintile from ages one through 17 had nearly 3.5 times higher

odds of being obese at least once between ages 18 and 30 compared to respondents who resided, on average, in the least disadvantaged neighborhood quintile.^{4,5}

Models 3 through 5 examine the effects of timing of exposure to neighborhood disadvantage during early childhood, late childhood, and adolescence, respectively, without regard for the other two developmental stages. There is no statistically significant association between young adult obesity and the average neighborhood disadvantage quintile to which respondents are exposed during early childhood (Model 3), while race remains a significant (although considerably attenuated) predictor. Exposures that occur during both late childhood (Model 4) and adolescence (Model 5), however, each have independent effects on future BMI. In particular, each unit (or quintile) increase in the average level of exposure to neighborhood disadvantage during late childhood and adolescence is related to a statistically significant 24% and 35% increase, respectively, in the odds of being obese at least once between ages 18 and 30. When all three developmental stages are included in the model simultaneously (Model 6), though, only the adolescent time period from ages 12 through 17 remains statistically significant.

To further explore this relationship and the disappearance of the late childhood effect from Models 5 to 6, additional analyses using different developmental cut-points were performed. These analyses revealed two rather than three distinct stages such that experiencing neighborhood disadvantage from ages 10 through 17 has a more consequential effect on obesity incidence in young adulthood than exposure that occurs between birth and age nine.

DISCUSSION

This study examined the effects of growing up in neighborhoods characterized by varying levels of disadvantage on obesity incidence in early adulthood utilizing the 1970 to 2011 waves of the PSID merged with census data on respondents' neighborhoods. Consistent with previous research, findings show that neighborhood disadvantage, defined by the spatial clustering of poverty, unemployment, female-headed households, public assistance receipt, and educational and occupational marginalization, is associated with higher BMI. Whereas prior studies in this area often characterize the residential environment only once or over just a short window of observation, this study employs yearly measurements of respondents' neighborhoods from birth through age 17, as well as statistical methods that account for dynamic individual- and household-level factors known to be predictive of future BMI but also related to the sorting of families into and out of neighborhoods over time. More specifically, this study is among the first to document that more prolonged exposure to neighborhood disadvantage throughout the entire child and adolescent lifecourse increases the risk of obesity in early adulthood, and in particular, that exposure to neighborhood disadvantage during adolescence is more consequential than exposure that occurs during earlier stages of development.

⁴ $\text{Exp}(5-1) \times 0.31 = 3.46$, where 0.31 is the log odds for the neighborhood disadvantage variable.

⁵These estimates exceed those produced using more conventional regression methods that condition on both time-invariant covariates as well as all time-varying covariates averaged over ages one to 17 (Appendix A), suggesting that prior research based on such techniques may over-control the indirect (or mediated) pathways through which prolonged neighborhood exposure impacts future BMI and black/white disparities therein.

As noted previously, this latter finding is consistent with the hypothesis that adolescence may be a sensitive period for neighborhood-obesity effects. Adolescence is a time of rapid growth and physiological change. It is also marked by an increasing need for autonomy and expanding social interactions. The residential neighborhood, in turn, often constitutes both the physical and social space in which youth spend a large part of their mounting out-of-home time [39]. These physical conditions and social experiences not only structure opportunities to make healthy choices but also shape norms, values, attitudes, knowledge, and behavioral tendencies related to food and exercise that are likely to carry forward into adulthood [28, 40]. More broadly, although both the duration and timing of exposure to neighborhood disadvantage affected the incidence of young adult obesity across racial groups, a more nuanced interpretation suggests that such consequences are likely to be more concentrated among black versus white young people. Black children and youth were not only more likely than their white counterparts to be born into neighborhoods characterized by higher levels of disadvantage and thus fewer social and structural resources for healthy eating and physical activity, but also more likely to remain in similar types of health-compromising residential environments for the entirety of their pre-adult years. This suggests that the separate and unequal neighborhood environments in which black versus white children and youth tend to live, learn, and grow may play a critical role in producing and perpetuating black/white disparities in obesity in adulthood.

Limitations

Although this study uses panel data and unique statistical methods to address some of the most common challenges in neighborhood effects research, the results should be considered in the context of several remaining limitations. First, given the historical timing of this study, the sample is limited to black and white respondents. Future research examining disparities in obesity as a function of cumulative and timing-specific neighborhood effects among Asian and Latino populations is encouraged. Second, analyses relied on self-reported height and weight to determine BMI. Clinical assessment would increase the objectivity associated with measurement of these characteristics and reduce the potential for bias due to differential reporting across sociodemographic groups. Third, although there appears to be sufficient overlap in the race-specific distributions of cumulative and timing-specific exposure to neighborhood disadvantage to satisfy the positivity assumption on which the analyses are based, it would be enlightening to find a sample in which neighborhood stratification by race is less pronounced in order to further disentangle the mechanisms behind the relationships among race, place, and BMI. Finally and relatedly, this study did not assess the specific mechanisms thought to help explain how neighborhood-obesity effects transpire but rather the broader neighborhood conditions thought to engender such processes. Longitudinal research able to more explicitly measure these potential mechanisms including, for example, continuity and change in supermarket and fast food outlet density, perceptions of safety, collective efficacy, and institutional resources, as well as their dynamic associations with contextual characteristics such as population and development density would be valuable.

Conclusions

Findings from the present study add to the growing body of evidence suggesting that place-based, developmentally-appropriate, and ongoing investments in the social, economic, institutional, and infrastructural aspects of under-resourced neighborhoods and neighborhoods of color can help reduce adult obesity incidence. This study further suggests that given practical and economic constraints, neighborhood-based efforts targeting the food and physical activity structures and behaviors of adolescents (rather than younger children) may be particularly successful. Whereas prior neighborhood effects research based on cross-sectional data may have concluded with similar general sentiments, the implementation of associated health practice and policy changes has often been hampered by challenges to causal inference. Using longitudinal data and a statistical method that attempts to model the full data distribution, this study provides among the strongest evidence to date for the consequences of both sustained and adolescent exposures to neighborhood disadvantage on future (young adult) obesity, especially among black children and youth for whom such exposures tend to be more common and more persistent.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1. Mean level of cumulative (ages 1-17) and timing-specific (ages 1-5, 6-11 and 12-17) exposure to neighborhood disadvantage for all respondents and for the black and white subsamples; NH=Neighborhood

Table 1

Time-invariant sample characteristics

	Total	Black	White
	(n=1,498)	(n=500)	(n=998)
Ever obese in early adulthood, percent			
BMI ≥ 30 kg/m ²	31.04	41.40	25.85
BMI < 30 kg/m ²	68.96	58.60	74.15
Average BMI across early adulthood, mean (SD)	26.75 (5.62)	28.30 (6.08)	25.97 (5.20)
Gender, percent			
Female	53.47	58.80	50.80
Male	46.53	41.20	49.20
Birthweight, percent			
Less than 88 ounces	7.01	10.20	5.41
88 ounces or more	92.99	89.80	94.59
Mother's marital status at birth, percent			
Unmarried	20.16	48.40	6.01
Married	79.84	51.60	93.99
Household head's education at birth, percent			
Less than high school	28.37	53.60	15.73
High school graduate	36.92	33.60	38.58
At least some college	34.71	12.80	45.69
Mother's age at birth, mean (SD)	24.59 (5.06)	22.75 (5.09)	25.51 (4.80)

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); BMI=Body mass index

Table 2

Time-varying sample characteristics

	Total (n=1,498)			Black (n=500)			White (n=998)		
	Age 3	Age 9	Age 15	Age 3	Age 9	Age 15	Age 3	Age 9	Age 15
Neighborhood disadvantage quintile, percent									
1 st quintile (least disadvantaged)	11.62	13.95	17.36	2.00	2.40	4.80	16.43	19.74	23.65
2 nd quintile	14.09	13.42	15.89	2.60	3.60	5.40	19.84	18.34	21.14
3 rd quintile	17.82	18.89	20.16	7.20	5.80	8.80	23.15	25.45	25.85
4 th quintile	23.03	21.63	20.29	16.40	16.60	19.00	26.35	24.15	20.94
5 th quintile (most disadvantaged)	33.44	32.11	26.30	71.80	71.60	62.00	14.23	12.32	8.42
Household head's marital status, percent									
Unmarried	16.96	22.16	25.90	37.20	44.40	49.60	6.81	11.02	14.03
Married	83.04	77.84	74.10	62.80	55.60	50.40	93.19	88.98	85.97
Household head's employment status, percent									
Unemployed	16.09	16.49	15.29	31.80	33.00	30.20	8.22	8.22	7.82
Employed	83.91	83.51	84.71	68.20	67.00	69.80	91.78	91.78	92.18
Public assistance receipt, percent									
Received public assistance	10.41	11.48	7.14	23.60	27.60	18.60	3.81	3.41	1.40
Did not receive public assistance	89.59	88.52	92.86	76.40	72.40	81.40	96.19	96.59	98.60
Homeownership, percent									
Does not own home	43.32	35.38	30.17	67.80	61.00	52.40	31.06	22.55	19.04
Owens home	56.68	64.62	69.83	32.20	39.00	47.60	68.94	77.45	80.96
Household income in (1985) \$1000, mean (SD)	19.34 (15.84)	22.79 (25.45)	25.86 (28.89)	15.13 (10.92)	15.96 (13.22)	17.47 (15.00)	21.45 (17.43)	25.79 (25.45)	30.07 (32.98)
Household head's work hours/week, mean (SD)	37.43 (17.22)	36.66 (18.12)	37.52 (17.54)	28.22 (17.88)	27.05 (19.56)	28.54 (19.44)	42.04 (14.89)	41.48 (15.24)	42.02 (14.57)
Family size, mean (SD)	4.28 (1.58)	4.55 (1.31)	4.04 (1.26)	4.74 (2.25)	4.70 (1.75)	4.62 (1.52)	4.06 (1.03)	4.47 (1.01)	4.30 (1.09)

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).

Table 3

Effects of duration and timing of exposure to neighborhood disadvantage from birth through age 17 on obesity incidence in early adulthood (n=1,498)

	Race-Only		Timing			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Average NH disadvantage quintile						
Ages 1 through 17		1.37 ***				
Ages 1 through 5 (early childhood)			1.10			0.92
Ages 6 through 11 (late childhood)				1.24 **		0.98
Ages 12 through 17 (adolescence)					1.35 ***	1.40 ***
Race (white)						
Black	2.03 ***	1.25	1.49 **	1.34	1.21	1.24
Gender (male)						
Female		1.15	1.14	1.15	1.13	1.12
Birthweight (88 ounces or more)						
Less than 88 ounces		0.88	0.92	0.89	0.87	0.87
Mother's marital status at birth (married)						
Unmarried		1.00	1.03	1.02	0.98	0.98
HH's education at birth (less than high school)						
High school graduate		0.83	0.80	0.83	0.84	0.84
At least some college		0.55 ***	0.49 ***	0.54 ***	0.55 *	0.54 ***
Mother's age at birth						
		1.00	1.00	1.00	1.00	1.00
NH disadvantage at birth						
		0.93	0.98	0.97	0.97	1.00
HH's marital status at birth (married)						
Unmarried		1.18	1.13	1.16	1.22	1.22
HH's employment status at birth (employed)						
Unemployed		1.11	1.12	1.11	1.11	1.12
Homeownership at birth (owns home)						
Does not own home		0.94	0.98	0.95	0.93	0.93
Family size at birth						
		0.94	0.94	0.94	0.94	0.95
Public assistance receipt at birth (none)						

	<u>Race-Only</u>		<u>Duration</u>		<u>Timing</u>			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6		
Received public assistance		0.51 **	0.53 *	0.52 **	0.49 **	0.49 **		
Household income at birth		1.03	1.00	1.02	1.05	1.05		
HH's work hours per week at birth		0.99	0.99	0.99	0.99	0.99		
Year born (1970-72)								
1973-1975		1.41 *	1.39	1.39	1.44 *	1.44 *		
1976-1978		1.38	1.35	1.36	1.41 *	1.41 *		
1979-1980		1.62 **	1.58 **	1.58 **	1.70 **	1.72 **		

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; NH=Neighborhood; HH=Household head;

* p<0.10;

** p<0.05;

*** p<0.01