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Neighborhood Disadvantage and Depressive Symptoms among Adolescents Followed into Emerging Adulthood

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Abstract

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Competing Interest

None declared.

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Background—Residents of disadvantaged neighborhoods report higher levels of depressive symptoms; however, few studies have employed prospective designs during adolescence, when depression tends to emerge. We examined associations of neighborhood social fragmentation, income inequality, and median household income with depressive symptoms in a nationally representative survey of adolescents.

Methods—The NEXT Generation Health Study enrolled 10th-grade students from 81 United States high schools in the 2009–2010 school year. Depressive symptoms were assessed with the Modified Depression Scale (Wave 1) and the pediatric Patient Reported Outcome Measurement Information System (Waves 2–6). Neighborhood characteristics at Waves 1, 3, 4, 5 were measured at the census tract level using geolinked data from the American Community Survey 5-year estimates. We used linear mixed models to relate neighborhood disadvantage to depressive symptoms controlling for neighborhood and individual sociodemographic factors.

Results—None of the models demonstrated evidence for associations of social fragmentation, income inequality, or median household income with depressive symptoms.

Conclusion—Despite the prospective design, repeated measures, and nationally representative sample, we detected no association between neighborhood disadvantage and depressive symptoms. This association may not exist or may be too small to detect in a geographically dispersed sample. Given the public health significance of neighborhood effects, future research should examine the developmental timing of neighborhood effects across a wider range of ages than in the current sample, consider both objective and subjective measures of neighborhood conditions, and use spatially informative techniques that account for conditions of nearby neighborhoods.

INTRODUCTION

The neighborhood environment appears to be an important determinant of mental health [1]. Neighborhood attributes linked to depression include socioeconomic disadvantage, instability, lack of social cohesion, and income inequality [2–4]. Social theories (e.g., social ecologic, social cognitive, social stress) [5] suggest that associations of neighborhood attributes with depression arise from lack of investment and limited resources for health-promoting behaviors in disadvantaged neighborhoods. Resource constraints break down social processes at the aggregate (e.g., through low social cohesion) and individual (e.g., through breaking social ties [6–10]) levels that benefit mental well-being [5]. Associations of low neighborhood income with depression may arise because of increased exposure to interpersonal violence and other stressful life events in contexts without sufficient social and material supports to buffer their effects [11], and high income inequality generates invidious social comparisons which are deleterious for mental health [12]. Associations of neighborhood income or income inequality with depression may also exist because of higher social fragmentation or lower social cohesion in more disadvantaged, less egalitarian places [13, 14].

Neighborhood economic disadvantage is captured by median household income and percentages of residents below the poverty line, with less than high school education, unemployed, and receiving public assistance. We found 26 studies showing that residents of neighborhoods with higher economic disadvantage had higher scores on depressive

symptom scales and higher risks of major depressive disorder (e.g., odds ratios 1.05 to 2.40) [3, 4]. Residents of neighborhoods with higher income inequality also had higher levels of depressive symptoms [12, 15, 16] However, there were 19 studies in which neighborhood disadvantage was not associated with depression.

In 12 studies, residents of socially disadvantaged neighborhoods (i.e., characterized by residential instability or low social cohesion) had higher mean levels of depressive symptoms and higher risks for clinical depression; conversely, residents of neighborhoods with lower social disadvantage (e.g., greater social cohesion) had lower scores and lower risks. In other studies, however, neighborhood social disadvantage was not associated with residents' depression.

These inconsistent findings may reflect methodologic differences between studies such as prospective versus cross-sectional study designs, focus on single regions or population subgroups rather than nationally representative samples, sample size, length of follow-up, definition of neighborhood (census tract or ZIP code versus respondent-defined neighborhood boundaries), assessment of disadvantage (Census data vs. respondents' perceptions), and measurement of depression. Prospective studies with longer follow-up periods were less likely to detect associations of neighborhood social or economic disadvantage with depression. The studies reporting associations were based on follow-up periods <5 years [3, 4, 17]. Of the studies reporting no associations between neighborhood context and depression, 9 had follow-up periods ≥ 5, and 5 followed up respondents for ≥ 10, years [3, 4, 17–20]. Notably, few studies with follow-up periods >5 years included repeated measures of neighborhood exposures, which could fail to detect associations if neighborhood effects decay over time.

Neighborhood studies of mental health, most of which focused on adults or young children [3, 4, 17], may also have missed the developmental period of greatest risk, as depression tends to emerge during adolescence [21, 22]. Pabayo et al. reported an association between higher income inequality and depressive symptoms among adolescent girls but not boys [12]. In contrast, Airaksinen et al. found that neighborhood socioeconomic conditions were not associated with depressive symptoms measured repeatedly over 5 waves in young adulthood, though neighborhood conditions were only assessed at baseline [18]. Similarly, in a 14-year study of depressive symptoms among U.S. adolescents, Barr found that Census-based neighborhood socioeconomic conditions at baseline were unrelated to depression, whereas participants' perceptions of neighborhood safety and neglect were associated with higher depressive symptoms [19]. However, the use of subjective measures is problematic if individuals with depression perceive their neighborhoods more negatively than individuals without depression [23, 24].

Because of these inconsistent findings, we examined prospective associations of 3 features of neighborhood conditions with depressive symptoms in a nationally representative sample of adolescents: social fragmentation, neighborhood income inequality, and median household income. We leveraged the following design strengths of the NEXT Generation Health Study ("NEXT"; [25]): 1) a nationally representative sample; 2) 6 annual follow-up assessments providing repeated measures of depressive symptoms through young adulthood;

and 3) repeated measurement of neighborhood exposures utilizing objective, Census-derived neighborhood characteristics geolinked to respondents' addresses at 4 study waves. We hypothesized that higher social fragmentation, lower median household income, and higher income inequality would be associated with higher levels of depressive symptoms between ages 16 and 22.

METHODS

Sample

NEXT enrolled a nationally representative sample of adolescents using a 3-stage stratified design targeting 10th graders enrolled in public, private or parochial high schools in the United States in school year 2009–2010 [25]. Primary sampling units (PSUs, n=27) consisted of school districts or groups of school districts stratified by U.S. Census divisions. Schools in each PSU with 10th-grade classes were sampled with probability proportional to enrollment; 58.4% of sampled schools (n=81) participated. All students within randomly selected classrooms (1 to 5 per school) were eligible to participate. Parents provided informed consent for their children's participation and youth provided assent (if <18 years of age) and consent once they reached 18 years of age. The protocol including informed consent procedures was approved by the institutional review board of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development and conforms to the principles embodied in the Declaration of Helsinki.

Among eligible students, 73.4% (n=2,786) participated. Baseline surveys were administered in 2009–2010; however, timing of school approval for participation resulted in the collection of baseline data for 260 respondents during Wave 2 (2010–2011, 11th grade). This study used data from the first 6 annual waves that were self-administered either in school or online. Retention rates were 86.8% at Wave 2, 83.9% at Wave 3, 75.9% at Wave 4, 76.6% at Wave 5, and 79.9% at Wave 6. Schools with large percentages of African American students were oversampled to obtain reliable estimates for them.

Measures

Depressive symptoms.—We assessed depressive symptoms at Wave 1 using the Modified Depression Scale (MDS) [26]. The MDS asks respondents to rate, on a Likert scale from "never" to "always," the frequency with which they experienced symptoms such as sadness, grouchiness or irritability, and increases or decreases in appetite and sleep over the past 30 days (Cronbach's α=0.76 to 0.80) [26–28].

At Waves 2–6, we measured depressive symptoms using the pediatric Patient Reported Outcome Measurement Information System (PROMIS [29]) scale. This scale asks respondents to rate, on a Likert scale from "never" to "almost always" [30], the frequency with which they experienced symptoms including feeling that they can't do anything right, feeling that everything in their lives had gone wrong, and being unable to stop feeling sad over the preceding 7 days (Cronbach's α=0.85 and test-retest reliability=0.76) [31]. The decision to switch from the MDS to the PROMIS reflected accumulating evidence of its

desirable psychometric properties such as internal consistency and test-retest reliability and discrimination over wider ranges of depressive severity [30–34].

Scores on the PROMIS were converted into *T*-scores based on distributions of scores in the general U.S. pediatric population. We analyzed depressive symptom *T*-scores for the PROMIS (mean=50, standard deviation=10) and MDS scores standardized to the same mean and standard deviation. The correlation between MDS at Wave 1 and PROMIS at Wave 2 was 0.48, very similar to correlations between PROMIS scores at any 2 consecutive waves (0.50 to 0.54), suggesting the two measures are performing similarly in the NEXT sample and justifying our combining them for analysis.

Neighborhood characteristics.—Respondents' home addresses were geocoded to census tracts at Waves 1, 3, 4, and 5. Consistent with previous studies of neighborhood disadvantage and adverse health outcomes [35–39], and because of their greater stability compared with single-year estimates, neighborhood measures were based on 5-year census tract-level estimates from the American Community Survey (ACS [40]): 2007–2011 for Wave 1, 2009–2013 for Wave 3, 2010–2014 for Wave 4, and 2011–2015 for Wave 5. Neighborhood characteristics were therefore updated based on respondents' geocoded census tracts at Waves 3, 4, and 5. Because respondents were not geocoded at Waves 2 and 6, we applied the values of the neighborhood variables at Wave 1 to Wave 2 and those at Wave 5 to Wave 6. All neighborhood variables were standardized to a mean of 0 and standard deviation of 1 in the total U.S. population and treated as time varying in all models. At baseline there were 1,105 census tracts represented in the sample; census tracts were more geographically dispersed than PSU's, with an average of 41 census tracts represented within each PSU.

Social Fragmentation is an index consisting of the sum of the standardized percentages in respondents' census tracts of female-headed households, residents living in the area <5 years, foreign born residents, and renters [41]. Single-parent households are significantly more likely than 2-parent households to be poor [42]. Poverty, particularly among single mothers, is a strong risk factor for lack of social support that might buffer the stress resulting from competing demands of supporting their families financially, parenting, and other life tasks [43–45]. This constellation of adversity may contribute to role overload [46]. Higher proportions of households in these circumstances may mean fewer adults able to act as long-term, stable, dependable sources of emotional and adaptive social support or consistently enforced norms of prosocial behavior [6, 47]. Cultural and linguistic barriers in neighborhoods with high proportions of immigrants [47, 48], and the residential instability and turnover that frequently characterize renters, may likewise make it difficult to develop and maintain such ties [17, 47, 48].

We assessed *income inequality* using the Gini Index [49]. A value of 0 denotes perfect income equality, whereas a value of 1 denotes the scenario of all income accruing to 1 individual. *Median household income* in the ACS was adjusted for inflation to the final year covered by each relevant 5-year estimate (e.g., 2014 for Wave 4) using the Consumer Price Index [50]. To enable the assessment of potentially nonlinear associations between

neighborhood variables and depressive symptoms, we categorized the neighborhood variables into quartiles of their distributions in the study sample for analysis.

Time-varying covariates adjusted for in the analyses were minority composition of the neighborhood (proportion non-White) and respondent age. Respondent-level covariates ascertained at baseline were sex, race/ethnicity (Hispanic/Latino, Black/African-American, White, other), and family socioeconomic status measured using Health Behaviour School-Aged Family Affluence Scale [51]. This scale is the summed score of 4 items querying family car (0, 1, 2+) and computer (0, 1, 2+) ownership, past-year frequency of family vacations (0, 1, 2+), and whether respondents had their own bedrooms (0=no, 1=yes). Scores ranged from 0 to 7 and were categorized as low (0–4), moderate (5–6), or high (7).

Analytic Approach

Respondents successfully geocoded to census tracts who provided data on sex, family affluence, race/ethnicity, age, and at least 1 measurement of depressive symptoms between Waves 1–6 of the study were included in the analysis sample (n=2,752). Among survey respondents at each wave, 18 of 2524 were missing geocodes at Wave 1, 3 of 2395 at Wave 3, 30 of 2177 at Wave 4, and 6 of 2202 at Wave 5.

We fit linear mixed models with random intercepts for PSUs and individual respondents nested within PSUs to account for the non-independence of respondents sampled from the same PSU and within-person correlation over time. The first set of models examined associations of each covariate with depressive symptoms adjusted only for respondent age. Next, we fit separate multivariable models examining each neighborhood exposure adjusted for respondent-level covariates (Model 1). As associations of neighborhood income and income inequality may be due in part to differences in social fragmentation across neighborhoods, we fit models with income only, income inequality only (Model 2) and both (Model 3), followed by a model that added social fragmentation (Model 4), each adjusted for respondent- and neighborhood-level covariates. All analyses incorporated NEXT's sampling weights and were performed using SAS version 9.4 (SAS Institute, Inc., Cary, NC).

RESULTS

The mean age of respondents at enrollment was 16.3 years. Forty-six percent of the sample was male; 55.7% self-identified as non-Hispanic White, 20.2% as non-Hispanic Black or African-American, 19.3% as Hispanic, and 4.8% as another race or ethnicity. Almost half (48.6%) reported moderate family affluence. Over the 6 survey waves, there were minimal changes in respondent depressive symptoms, family affluence, race/ethnicity, and neighborhood income inequality, percentage of minority residents, and median household income (Table 1). However, the percentages of male respondents decreased and residents of more socially fragmented neighborhood increased over time.

Distributions of depressive symptom *T*-scores by quartiles of neighborhood exposures within each wave are shown in Figure 1. The distribution of depressive symptoms was virtually the same across quartiles of the neighborhood social fragmentation, median income, and income inequality.

Results of linear mixed models of depressive symptoms are shown in Table 2. None of the models demonstrated evidence for associations of social fragmentation, income inequality, or median household income with depressive symptoms. For example, in the final regression model, there was no difference in mean depressive symptoms between residents of neighborhoods at the highest versus lowest quartiles of disadvantage: 0.06 for social fragmentation (95% confidence interval [18]: −0.95, 1.07); −0.43 for income inequality (95% CI: −1.14, 0.29); and −0.27 for median income (95% CI: −1.19, 0.64).

DISCUSSION

We used repeated annual measures from a prospective study of 2,752 respondents enrolled in 10th grade to examine associations of Census-based indicators of neighborhood social and economic disadvantage with depressive symptoms from mid-adolescence into emerging adulthood. We found no evidence of associations of social fragmentation, income inequality, or median household income of respondents' neighborhoods and their levels of depressive symptoms.

Our study incorporated design strengths long advocated by neighborhood researchers: prospective follow-up, population-based sample not limited to a single geographic area, and objective, repeated assessments of neighborhood characteristics. Moreover, our study was conducted during a developmentally sensitive period for depression and used reliable measures of depressive symptoms. Given these strengths, our findings cast doubt on the existence of robust relationships between neighborhood social and economic disadvantage and depression among adolescents and emerging adults. These findings are compatible with those reported by many but not all studies with follow-up periods longer than 5 years [3, 4, 17, 52], and specifically with those reported by Airaksinen et al. [18] and Barr [19] that followed young people into adulthood. Although adolescence and emerging adulthood are important developmental phases for depression, our results, together with those of previous studies [3, 4, 17, 52], suggest that neighborhood structural characteristics may be more important during other phases. Alternatively, adolescents' individual, family, or contextual factors during the period captured by the study that operated more proximally to the young people than their residential neighborhoods, which we were unable to measure, may have obscured any influences of their neighborhoods. Additionally, although neighborhood effects may decay over time, there may also be lagged effects over longer intervals than our study could capture.

Barr [19] found that associations between neighborhood disadvantage and depressive symptoms disappeared after respondent, parent, and interviewer perceptions of neighborhood safety and physical neglect were accounted for. If individuals do not perceive their neighborhoods as disadvantaged, neighborhoods with objectively disadvantageous structural characteristics may not be associated with a higher risk for depression. Adolescents and young adults may be less likely to perceive their neighborhoods as disadvantaged than older individuals, even in the presence of objective indicators, if their peers in similar neighborhoods also do not perceive their neighborhoods as disadvantaged [53]. Alternatively, supportive relationships with peers may buffer the stressors associated with neighborhood adversity that are implicated in the etiology of depression [53].

Potential study weaknesses include the use of 2 different measures of depressive symptoms with 2 different reporting periods and 2 different underlying metrics over the course of the study. However, results did not change when we reanalyzed the data using only the outcomes measured by the PROMIS. Short scales of depressive symptoms may not be sufficiently sensitive for detecting small to moderate neighborhood effects. The lack of neighborhood data from Waves 2 and 6 is also a potential concern; our inability to update neighborhood data at these waves could have attenuated associations with depressive symptoms if respondents moved to neighborhoods with qualitatively different social and economic conditions. Although residential census tracts are standard units of analyses in studies of neighborhood exposures, individuals' daily lives may span multiple census tracts beyond their residences. There may also be substantial sociodemographic segregation within tracts that our measures did not capture.

Given the design strengths of our study – nationally representative and diverse sample, repeated assessments of both neighborhood characteristics and depressive symptoms, and reliable measures of depression – it is tempting to interpret our results as suggesting that, at least on a national level and among adolescents and emerging adults, neighborhood social and economic characteristics are not associated with mental health. Nevertheless, the potential weaknesses noted above and generally discounted in the aggregate may have obscured real but small effects. The public health implications of putative neighborhood effects are important because they can have diffuse impacts over large numbers of individuals and because of the substantial burden attributable to depression [54]. Therefore, we offer the following suggestions for strengthening future studies.

Future attempts to resolve inconsistent findings concerning the role of neighborhood disadvantage in the risk of depression across the life course will benefit from incorporating prospective designs spanning multiple developmental phases, particularly the highest-risk periods of adolescence and early adulthood [21, 22]. Future studies might also consider both objective and subjective neighborhood measures and accessibility of services and amenities such as green space that might mitigate deleterious effects of neighborhood disadvantage [55]. Multiple statistical approaches could be utilized, including spatial analyses that take conditions of nearby neighborhoods into account and provide finer-grained characterization of respondents' neighborhoods. Clarifying the potential mental health risks associated with neighborhood disadvantage, including their developmental phase specificity, and identifying neighborhood-level targets for intervention, will ultimately benefit efforts toward optimizing the mental health of adolescents and emerging adults.

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Data Sharing: Data from the Next Generation Health Study are available through the Data and Specimen Sharing Hub (DASH), a centralized data resource for researchers to access data from research studies funded by the *Eunice*

Kennedy Shriver National Institute of Child Health and Human Development for use in secondary research. For further information, please visit: https://dash.nichd.nih.gov/.

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What is already known on this subject

- Neighborhood social and economic disadvantage, social fragmentation, and income inequality have been associated with depression in some but not all studies.
- Few prospective follow-up studies of neighborhood effects on depression have been conducted during adolescence, when depression tends to emerge, few have utilized nationally representative samples, and few have obtained repeated measures of neighborhood characteristics.

What this study adds

- We detected no associations of neighborhood disadvantage with depressive symptoms from mid-adolescence into emerging adulthood despite a prospective design, nationally representative United States sample, and repeated measures of both neighborhood disadvantage and depressive symptoms.
- Neighborhood effects on depression may be too small to detect in geographically dispersed samples of adolescents and young adults.
- Future research should consider the developmental timing of neighborhood effects, assess both objective and subjective neighborhood measures, and utilize multiple analytic approaches, including spatial techniques that account for conditions of nearby neighborhoods and provide more refined characterization of individual respondents' neighborhood exposures.

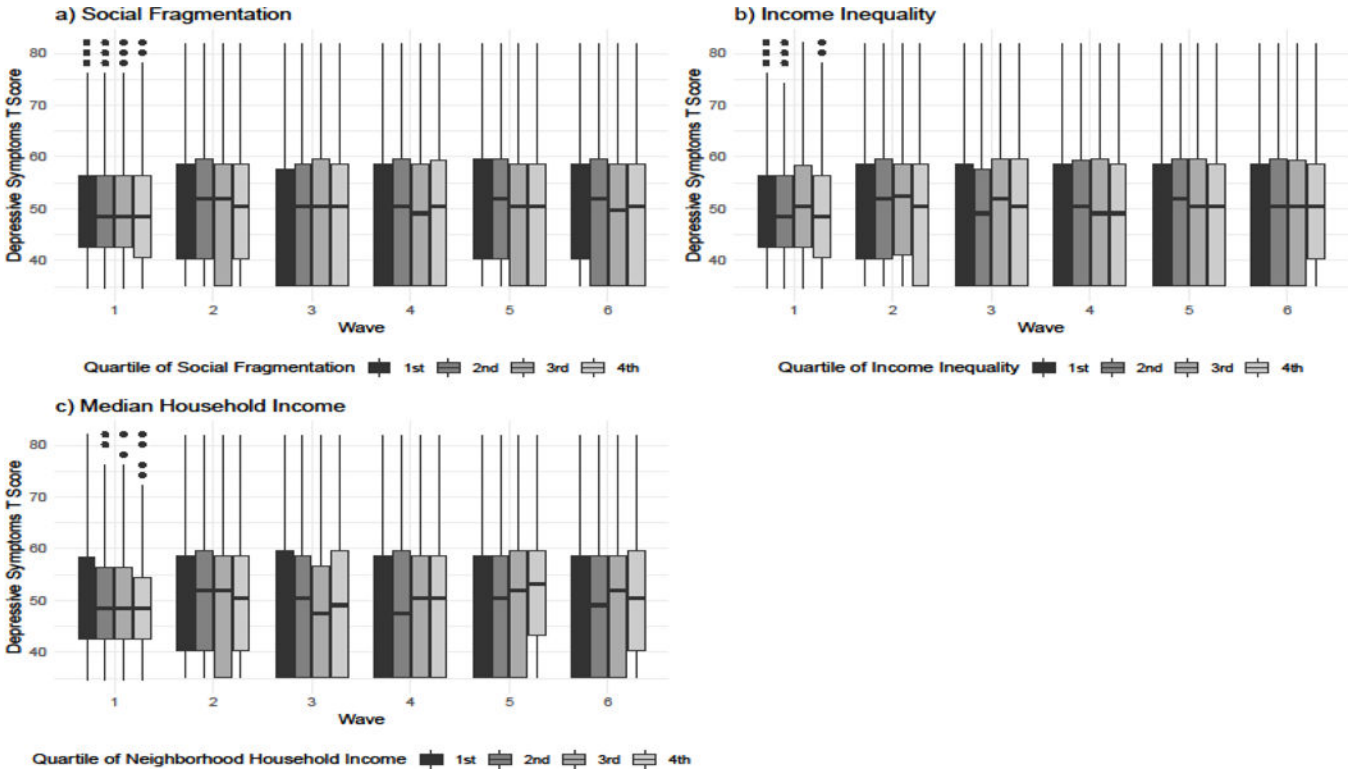

Figure 1. Depressive Symptom Scores at Waves 1–6 across Quartiles of Neighborhood Characteristics, NEXT Generation Health Study

Boxplots of depressive symptoms are shown across waves 1–6 of the study for each quartile of neighborhood social fragmentation (panel a), income inequality (panel b), and median household income (panel c).

Table 1.

Sociodemographic Characteristics of NEXT Respondents (Total N = 2752) and Their Residential Neighborhoods by Survey Wave, % or Mean (Standard Error)[a]

Characteristic	Wave 1 (n= 2486)	Wave 2 (n=2388)	Wave 3 (n=2354)	Wave 4 (n=2088)	Wave 5 (n=2118)	Wave 6 (n=2042)
Depressive symptom *T*-score	50.7 (0.4)	51.2 (0.5)	50.5 (0.6)	50.4 (0.4)	51.2 (0.4)	50.9 (0.4)
Neighborhood Characteristics						
Social Fragmentation Index[b]						
Lowest quartile	33.2 (4.9)	32.2 (5.3)	32.6 (5.6)	35.9 (3.7)	36.3 (4.2)	33.9 (4.6)
Second quartile	43.8 (6.3)	43.4 (6.2)	40.4 (6.1)	29.2 (3.2)	32.2 (3.6)	32.3 (3.8)
Third quartile	14.3 (4.2)	15.6 (4.5)	17.2 (4.5)	18.4 (3.0)	18.4 (2.7)	19.9 (3.0)
Highest quartile	8.8 (3.7)	8.9 (3.6)	9.9 (3.7)	16.5 (2.4)	13.0 (2.8)	13.8 (3.0)
Gini coefficient of income inequality[b]						
Lowest quartile	29.5 (5.7)	29.6 (5.8)	27.8 (5.3)	28.3 (3.8)	29.4 (3.4)	28.8 (3.5)
Second quartile	25.0 (2.5)	24.2 (2.4)	25.4 (2.9)	24.7 (2.7)	26.8 (2.9)	25.6 (3.0)
Third quartile	25.6 (4.3)	24.8 (4.1)	23.9 (3.5)	24.9 (3.8)	26.1 (3.0)	26.5 (3.1)
Highest quartile	19.9 (5.3)	21.4 (5.6)	23.0 (5.4)	22.2 (2.0)	17.7 (2.9)	19.1 (3.1)
Neighborhood median household income[b]						
Lowest quartile	20.1 (5.6)	21.3 (5.8)	20.7 (5.2)	23.3 (2.8)	20.7 (2.4)	22.4 (3.0)
Second quartile	18.0 (3.6)	17.6 (3.4)	20.2 (3.2)	20.9 (2.5)	21.0 (2.6)	22.3 (3.0)
Third quartile	30.1 (4.9)	29.5 (4.8)	28.6 (4.6)	30.2 (3.1)	29.1 (3.2)	26.4 (3.3)
Highest quartile	31.8 (5.5)	31.6 (5.7)	30.5 (5.5)	25.6 (3.6)	29.2 (4.3)	28.9 (4.3)
Percentage of minority residents[b]						
Lowest quartile	33.0 (5.5)	32.8 (5.8)	31.6 (5.7)	36.1 (4.6)	34.0 (4.7)	32.1 (5.0)
Second quartile	44.9 (6.9)	43.4 (6.8)	43.7 (6.8)	38.8 (4.9)	42.4 (5.7)	40.3 (6.0)
Third quartile	13.5 (3.6)	12.7 (3.5)	13.6 (3.6)	14.3 (3.3)	14.2 (3.2)	15.3 (3.3)
Highest quartile	8.6 (4.5)	11.1 (5.2)	11.1 (5.2)	10.9 (3.2)	9.4 (3.2)	12.3 (4.2)
Respondent/Family-Level Characteristics						
Sex (% male)	45.6 (1.7)	44.8 (1.8)	44.8 (1.6)	41.2 (2.0)	40.1 (1.9)	38.4 (1.9)
Age	16.3 (0.03)	17.2 (0.03)	18.2 (0.03)	19.2 (0.02)	20.3 (0.02)	21.3 (0.02)
Race or ethnicity						

Characteristic	Wave 1 (n= 2486)	Wave 2 (n=2388)	Wave 3 (n=2354)	Wave 4 (n=2088)	Wave 5 (n=2118)	Wave 6 (n=2042)
Non-Hispanic White	57.8 (5.4)	58.8 (6.0)	58.8 (6.0)	62.1 (5.8)	61.1 (5.3)	57.1 (6.3)
Non-Hispanic Black/African-American	17.6 (3.6)	17.3 (4.1)	17.1 (4.1)	13.5 (3.3)	13.6 (3.4)	19.7 (4.9)
Hispanic	19.7 (3.9)	19.5 (4.0)	19.9 (3.9)	19.5 (4.3)	19.9 (3.8)	18.7 (3.8)
Other	5.0 (1.1)	4.3 (1.0)	4.1 (0.8)	4.9 (1.0)	5.4 (1.0)	4.5 (1.1)
Family affluence						
Low	23.9 (2.7)	23.0 (2.9)	23.0 (3.1)	22.2 (2.7)	22.5 (2.6)	22.4 (3.1)
Medium	48.8 (1.5)	49.8 (1.2)	49.0 (1.5)	48.3 (1.8)	49.2 (1.5)	49.5 (1.6)
High	27.3 (2.5)	27.2 (2.5)	28.0 (2.8)	29.4 (2.7)	28.4 (2.6)	28.1 (2.7)

[a] Wave-specific percentages for some variables do not add to 100% because of rounding.

[b] Neighborhood measures at each wave were standardized to a mean of 0 and standard deviation of 1 in all U.S. census tracts.

Table 2.

Regression Coefficients (95% Confidence Intervals) from Linear Mixed Models of Depressive Symptoms in the NEXT Generation Health Study, Waves 1–6 (n=2,752).

Characteristic	Age-adjusted[c]	Model 1[d]	Model 2[e]	Model 3[f]	Model 4[g]
Neighborhood					
Gini coefficient of income inequality[a,b]					
Lowest quartile	Referent	Referent	Referent	Referent	Referent
Second quartile	0.17 (−0.35, 0.69)	0.10 (−0.43, 0.64)	0.10 (−0.45, 0.64)	0.10 (−0.45, 0.66)	0.15 (−0.43, 0.73)
Third quartile	−0.23 (−0.79, 0.33)	−0.33 (−0.90, 0.23)	−0.41 (−1.00, 0.17)	−0.38 (−0.98, 0.21)	−0.34 (−0.96, 0.28)
Highest quartile	−0.34 (−0.93, 0.24)	−0.43 (−1.02, 0.16)	−0.56 (−1.18, 0.05)	−0.46 (−1.14, 0.22)	−0.43 (−1.14, 0.29)
F, df=3 (P)	1.3 (0.26)	1.7 (0.18)	2.4 (0.07)	1.6 (0.18)	1.6 (0.18)
Median household income[a,b]					
Lowest quartile	−0.31 (−0.92, 0.30)	−0.46 (−1.09, 0.17)	−0.54 (−1.20, 0.11)	−0.30 (−1.01, 0.42)	−0.27 (−1.19, 0.64)
Second quartile	0.10 (−0.51, 0.72)	0.03 (−0.60, 0.65)	−0.06 (−0.68, 0.57)	0.03 (−0.63, 0.69)	0.06 (−0.68, 0.80)
Third quartile	−0.26 (−0.81, 0.30)	−0.28 (−0.86, 0.31)	−0.36 (−0.92, 0.20)	−0.29 (−0.87, 0.28)	−0.27 (−0.88, 0.34)
Highest quartile	Referent	Referent	Referent	Referent	Referent
F, df=3 (P)	1.0 (0.39)	1.3 (0.27)	1.5 (0.22)	0.8 (0.50)	0.7 (0.53)
Social Fragmentation Index[a,b]					
Lowest quartile	Referent	Referent			Referent
Second quartile	0.22 (−0.28, 0.72)	0.12 (−0.40, 0.64)			0.06 (−0.54, 0.66)
Third quartile	−0.32 (−0.95, 0.31)	−0.49 (−1.16, 0.18)			−0.56 (−1.39, 0.27)
Highest quartile	0.17 (−0.52, 0.87)	0.03 (−0.75, 0.82)			0.06 (−0.95, 1.07)
F, df=3 (P)	1.3 (0.27)	1.6 (0.20)			1.7 (0.17)
Percentage of race/ethnic minority residents[a,b]					
Lowest quartile	Referent	Referent		Referent	Referent
Second quartile	0.54 (0.02, 1.06)	0.45 (−0.07, 0.97)		0.61 (0.07, 1.16)	0.66 (0.09, 1.23)
Third quartile	0.66 (−0.06, 1.37)	0.48 (−0.31, 1.26)		0.71 (−0.08, 1.50)	0.88 (0.01, 1.74)
Highest quartile	0.19 (−0.63, 1.01)	−0.07 (−1.00, 0.86)		0.14 (−0.79, 1.07)	0.32 (−0.66, 1.31)

Characteristic	Age-adjusted[c]	Model 1[d]	Model 2[e]	Model 3[f]	Model 4[g]
F, df=3 (P)	2.0 (0.12)	1.7 (0.16)		2.6 (0.05)	2.5 (0.06)
Respondent/Family					
Age, per year[b]				−0.08 (−0.17, 0.00)	−0.08 (−0.16, 0.01)
Male Sex	−4.95 (−5.62, −4.29)			−4.94 (−5.61, −4.27)	−4.95 (−5.62, −4.28)
Race/Ethnicity					
Non-Hispanic White	Referent			Referent	Referent
Non-Hispanic Black/African American	0.83 (−0.13, 1.80)			0.38 (−0.68, 1.43)	0.41 (−0.73, 1.55)
Hispanic or Latino	0.18 (−0.72, 1.09)			0.17 (−0.84, 1.18)	0.19 (−0.87, 1.25)
Other	2.58 (0.97, 4.19)			2.22 (0.61, 3.84)	2.22 (0.58, 3.86)
F, df=3 (P)	3.9 (0.01)			2.6 (0.05)	2.5 (0.06)
Family Affluence					
Low	0.51 (−0.44, 1.45)			0.60 (−0.33, 1.53)	0.59 (−0.35, 1.54)
Medium	−0.09 (−0.95, 0.77)			0.13 (−0.72, 0.98)	0.13 (−0.71, 0.98)
High	Referent			Referent	Referent
F, df=2 (P)	1.1 (0.35)			1.0 (0.38)	0.9 (0.40)

[a] Age and neighborhood characteristics are modeled as time varying.

[b] Neighborhood measures at each wave were standardized to a mean of 0 and standard deviation of 1 in all U.S. census tracts.

[c] Each variable is modeled separately, adjusted only for respondent age.

[d] Each neighborhood characteristic is analyzed in a separate regression adjusted for respondent- and family-level covariates.

[e] Income inequality and median household income are modeled separately, each adjusted for respondent-/family- and neighborhood-level covariates.

[f] Income inequality and median household income are modeled simultaneously, adjusted for respondent-/family- and neighborhood-level covariates.

[g] All neighborhood, respondent- and family-level characteristics are entered simultaneously into a single model.