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Exposure to neighborhood immigrant concentration from adolescence to young adulthood and immune function among Latino young adults

Jodi L. Ford, Ph.D. and

Ohio State University, College of Nursing, 320 Newton Hall/1585 Neil Ave. Columbus, OH 43210, 614-292-6862 (phone), 614-292-4948 (fax)

Christopher R. Browning, Ph.D.

Ohio State University, Department of Sociology, 214 Townshend Hall/1885 Neil Ave Mall, Columbus, OH 43210, 614-292-2983 (phone)

Jodi L. Ford: ford.553@osu.edu; Christopher R. Browning: browning.90@osu.edu

Abstract

The immune system plays a critical role in the prevention of infectious and chronic disease. We investigate associations between exposure to neighborhood immigrant concentration across the transition from adolescence to adulthood and immune function among Latino young adults, including moderation by nativity. Data from the National Longitudinal Study of Adolescent Health (1994–2008) were analyzed. Immune function was measured via Epstein-Barr virus (EBV) antibody levels (higher levels indicate impaired immune function) among EBV-positive Latino adults (N=1130). Results indicated the averaged individual exposure to immigrant concentration (mean % of foreign-born residents in the census tract across waves 1–4) was associated with immune function for foreign-born Latinos only ($b=-0.37$, $P<0.05$). For waves of exposure, only the cumulative measure of living in an immigrant enclave (census tracts with ≥40% foreign-born residents) across all waves was associated with immune function and only for foreign-born Latinos ($b=-0.22$, $P<0.05$). Research on the mechanisms through which neighborhood immigrant concentration confers salubrious physiological outcomes for foreign-born Latinos is needed.

Keywords

Neighborhood; stress; immune function; Latinos; immigrant enclave

Correspondence to: Jodi L. Ford, ford.553@osu.edu.

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Introduction

A burgeoning field of research has found that exposure to neighborhood adversity (e.g. poverty, violence) is associated with physiological stress, in part, through the dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis system and the consequent alterations in cortisol secretion.[1–4] If prolonged or recurrent, imbalances in the HPA system can subsequently compromise immune system function.[5] Latent herpes viruses (e.g. Epstein-Barr virus [EBV], cytomegalovirus [CMV], herpes simplex 1 and 2 [HSV-1/HSV-2]) are particularly useful biomarkers to examine the impact of stress on the cell-mediated immune response – one aspect of the innate immune system that plays a critical role in protecting the body's cells from invading foreign pathogens and cancer cells.[5–10] Specifically, after the initial infection, latent herpes viruses remain latent or dormant for life. However, if the cellular immune response becomes impaired, reactivation of these viruses can occur as evident by an increase in antiviral antibodies.[6–10] Although viral reactivation often produces no symptoms, inflammation and further impairment of immune function ensues, which increases susceptibility to other infectious diseases, cancer, cardiovascular disease and autoimmune disorders, particularly if viral reactivation is prolonged or recurrent.[5–10]

To date, however, research on neighborhood factors that may be protective with respect to physiologic stress outcomes, including immune function, is comparatively limited. We focus on the role of residence in high proportion immigrant neighborhoods in the U.S. in reducing exposure to environmental stressors among Latinos. Prior research supports this line of inquiry as residence in a neighborhood with high concentrations of Latino immigrants was associated with a protective health benefit for Latinos across a range of outcomes, including a lower prevalence of depression,[11] preterm birth,[12] hypertension[13] and obesity (adult women only).[14] Immigrant enclaves are hypothesized to reduce exposure to stress through a number of neighborhood social processes, including enhanced social support,[15–16] beneficial social ecologies promoting conventional use of public space,[17] reduced violence[18–20] and reduced exposure to racism.[21] However, several studies have found that residence in a Latino immigrant enclave was protective only for foreign-born Latinos and not for those born in the U.S.[22–24] On an ecological level, researchers have hypothesized that native-born Latino residents of immigrant concentrated communities may have more heterogeneous spatial, institutional, and social exposures than their foreign-born counterparts, limiting the health benefits of residence in neighborhoods with a significant immigrant presence.[22] Thus, research is needed examining whether this disparity by nativity also extends to physiologic stress outcomes.

To advance understanding of the association between residence in an immigrant enclave and Latino physiologic stress outcomes, research framed in life course approaches is needed. At the individual level, prior research has identified that exposure to early life adversity (e.g. abuse/violence, household poverty) increases the risk for impaired immune function during adulthood as measured by reactivation of latent herpes viruses and increases in antiviral antibodies.[25–29] However, due to the limited availability of appropriate data, neighborhood research has only recently begun to test life course hypotheses on the relationships between neighborhoods and physiologic health. For example, Gustafsson et al.[30] found that increased exposure to cumulative neighborhood disadvantage (e.g. averaged exposure) from 16 to 43

years was associated with a higher allostatic load for males at age 43 years, above and beyond their cumulative individual living conditions. Others testing the timing of neighborhood exposure over the transition from adolescence to young adulthood found that exposure to neighborhood poverty during adolescence, but not young adulthood, increased the odds of having a biologically determined sexually transmitted infection (e.g. Chlamydia) during young adulthood, adjusted for a range of risk factors.[31] However, associations between potentially beneficial neighborhood exposures, such as immigrant concentration, and health across the life course have yet to be explored.

Our study builds on the aforementioned research using a longitudinal nationally representative sample to examine the associations between Latino adults' exposure to neighborhood immigrant concentration during the transition from adolescence to adulthood and cell-mediated immune function in adulthood, including the extent to which these relationships varied by nativity (e.g. U.S. vs foreign-born). We focus on reactivation of the Epstein-Barr virus (EBV) as this latent herpes virus is one of the most prevalent - 90% of the U.S. population experiences primary infection prior to 18 years of age.[6,9,10,32] EBV, which causes mononucleosis, has also been linked to cardiovascular disease,[33,34] certain cancers (e.g. Burkitt's lymphoma, Hodgkin's and non-Hodgkin's lymphoma, gastric cancer and nasopharyngeal carcinoma)[35] and autoimmune disorders (e.g. systemic lupus erythematous, multiple sclerosis).[36–37] Thus, EBV reactivation is not only a biomarker signaling immune dysregulation, but the virus also increases susceptibility to a host of negative health outcomes.

Methods

Study Design and Sample

Secondary data from the National Longitudinal Study of Adolescent Health (Add Health), waves 1 – 4 were examined. To date, Add Health has collected four waves of data from multiple sources and contexts providing a rich data source to examine the effects of the social environment on health and well-being during the transition from adolescence to adulthood.[38] Add Health employed a school-based sampling design (80 high schools and 52 middle schools) that is representative of U.S. schools in 1994–1995 with respect to region of country, urbanicity, school size, school type, and ethnicity.[38] The first wave of data was collected in 1994–1995, the second wave in 1996, the third wave in 2003 and the fourth wave in 2008. The overall unweighted response rate for the four waves was 80.3%; Add Health analyses found negligible non-response bias and concluded that wave 4 participants were representative of those from wave 1.[39]

Measures

Dependent Variable

Cell-Mediated Immune Function: Cell-mediated immune function was measured via EBV viral capsid antigen (VCA) IgG antibody levels among EBV positive adults (e.g. higher antibody levels are a marker for EBV reactivation). Because EBV reactivation occurs when cell-mediated immune function decreases, the measure is widely recognized as a valid measure of impaired cellular immunity.[6–10,39,40] Add Health collected EBV VCA IgG

antibodies at wave 4 via capillary dried blood spots that were analyzed by the Department of Laboratory Medicine at the University of Washington.[41] A commercial ELISA kit (DiaSorin, Stillwater, MN) was used to assay the blood spots for the EBV VCA IgG antibodies; the sensitivity of the EBV assay was 9 AU/ml (plasma equivalent of 25), the within-assay coefficient of variation was 3.9%, and between-assay coefficient of variation was 10.2%. EBV concentrations (AU/ml) of a sample of dried blood spot and paired serum samples were strongly correlated.[41] The EBV antibody levels were positively skewed in our univariate analyses, thus the measure was log transformed.

Primary Independent Variables of Interest

Individual Exposure to Neighborhood Immigrant Concentration: The neighborhood was defined as the census tract of residence. Measures are provided to researchers in the Add Health contextual data.[37] Neighborhood indicators from waves 1 and 2 were derived from the 1990 U.S. Census, wave 3 from the 2000 U.S. Census and wave 4 from the 2009 American Community Survey 5-Year Estimates. For this study, neighborhood immigrant concentration was measured at each wave as the proportion of foreign-born residents living in the census tract. Several measures were created from these data to examine the effects of neighborhood immigrant concentration on immune function. Because the outcome measure was only available at wave 4 and our focus was on the average or cumulative effects of immigrant concentration on immune function across time, all neighborhood measures were disaggregated to the individual level. First, *the averaged individual exposure to neighborhood immigrant concentration* from adolescence to adulthood was operationalized as the mean of the single measure – proportion of foreign-born residents in the census tract – across the four waves of the study; a methodology consistent with prior research.[30] In addition, we created a categorical measure adding the number of waves the respondent lived in an immigrant enclave over the transition from adolescence to adulthood. We defined an immigrant enclave as census tracts in which 40% or more of the residents were foreign-born and created the following measures: *cumulative exposure across the transition from adolescence to adulthood* (participant lived in an immigrant enclave at all four waves), *exposure at three waves only* (participant lived in an immigrant enclave for three time points only), *exposure at two waves only* (participant lived in an immigrant enclave for two time points only), *exposure at one wave only* (participant lived in an immigrant enclave for only one time point) versus never exposed (participant never lived in an immigrant enclave).

Nativity: Nativity was measured as U.S. born (yes=1) versus foreign-born.

Control Variables: Control measures for all analyses included: *age in years at wave 1*, *gender* (male=1); *highest level of parental education at wave 1* (less than high school, high school degree/GED, some college vs college degree or more); lived with both biological parents at wave 1; *receipt of public assistance*, averaged across the four waves (e.g. if the participant or parent/caregiver received food stamps, housing assistance, or welfare payments then the receipt of public assistance=1 for that wave; mean value calculated across the four waves); *participant college degree at wave 4; number of times moved between waves 1 – 3* (Add Health did not include a similar measure at wave 4 to assess number of times moved between waves 1 – 4); *subclinical symptoms in the prior week* (e.g. count of

items such as fever); and *common infectious or inflammatory diseases* (e.g. count of diseases, such as influenza, rheumatoid arthritis). In addition, control measures of the *averaged individual exposure to neighborhood poverty* (proportion of persons in the census tract receiving public assistance at each wave, summed and averaged for each individual) and the *averaged individual exposure to residential stability* (proportion of persons living in the census tract for 5 or more years at each wave, summed and averaged for each individual) during the transition from adolescence to adulthood were included in all models.

Sample

The sampling frame for this study consisted of Latino participants from all four waves who were EBV seropositive due to our interest in investigating EBV viral reactivation – a marker of immune function – rather than primary infection. Because the Add Health documentation does not identify the cut-off values for EBV seronegative individuals, the protocol developed by Dowd et al.,[42] was employed in which participants in the bottom 10% of the range of EBV antibody levels were considered to be EBV negative (n=126 who had EBV VCA IgG antibodies < 52 AU/ml). Participants missing data on model covariates were excluded from analysis (n=44 or 3.8%) for a final sample size of 1130. We found no statistically significant differences in the levels of EBV antibodies, neighborhood immigrant concentration, or nativity status between adults excluded from the sample for missing data and those included in the final analysis.

Analysis

Descriptive statistics were conducted using SAS survey procedures, version 9.2 (SAS Institute, Cary, NC). For multivariable analyses, random intercept linear regression models were estimated adjusting standard errors for clustering within wave 1 neighborhood of residence (subsequent waves had greater geographic dispersion) using HLM 6.08 software (Scientific Software International, Lincolnwood, IL). Because Add Health does not provide survey weights for multilevel models analyzing neighborhoods, all analyses were conducted unweighted. However, school stratification variables were included in the analyses to adjust for the sampling design as directed by Add Health (personal communication, Kim Chantala, Add Health User's Conference, 2008). These variables included geographic area (Northeast, West, Midwest, and South), school size, school urbanicity, school type (public or private) and ethnic mix (proportion of students who were non-Latino White). Sensitivity analyses were conducted using standard multivariable linear regression, weighted (to account for attrition, oversampling) and adjusted for the complex survey design (school clustering only). Findings of both analytic strategies were consistent except the standard errors were smaller for the standard regression design (adjusted for school clustering only) versus the multilevel design (adjusted for school and neighborhood clustering). Thus, we present results from the more conservative multilevel model estimates.

To address the study questions, four random intercepts linear regression models, adjusted for the control measures, were estimated. Model 1 focused on associations between the averaged individual exposure to neighborhood immigrant concentration during the transition from adolescence to adulthood and adult EBV antibody levels whereas in model 2, we included the interaction term (immigrant concentration X U.S. born) to examine the extent

to which the association varied by nativity. In models 3 and 4 we examined the associations between the categorical measure of the number of waves the participant lived in an immigrant enclave over the transition from adolescence to adulthood and immune function (model 3) and the extent to which nativity moderated this association (model 4). In all of the moderation models, we interact immigrant concentration with U.S. born Latinos, thus the main effect represents the parameter estimate for foreign born Latinos. Sensitivity analyses were conducted in which we examined the associations and interactions with nativity between immune function and living in an immigrant enclave during adolescence only (wave 1 or 2), during adulthood only (wave 3 or 4) or cumulatively across all 4 waves; the findings were consistent with both approaches.

Results

Descriptive Findings

Table 1 presents the characteristics of the study sample of 1130 EBV positive Latino adults. The mean EBV antibody level was 167.7 AU/ml (49.0–982.0) with the logged measure value at 4.97 (3.89–6.89). The majority of the sample (80%) was U.S. born and 45% was male. More than half of the participants lived with both biological parents (58%) at wave 1. Nearly half (46%) of the participants had a parent with less than a high school degree while 24% of the participants had a college degree at wave 4. Approximately 16% of the sample received public assistance on average across the waves. The averaged individual exposure to neighborhood immigrant concentration across the four waves was 0.28. Nearly 12% of the sample lived in an immigrant enclave at all four waves, 7% for any three waves, 10% for any two waves, 17% for one wave only, and 54% never lived in an immigrant enclave.

Multivariable Findings

Table 2 presents the findings of the random intercepts linear regression models on the associations between individual exposure to neighborhood immigrant concentration during the transition from adolescence to adulthood and EBV antibodies among EBV positive Latino adults. In model 1, the averaged individual exposure to immigrant concentration was negatively associated with EBV antibody levels. Specifically for every 1% increase in the averaged individual exposure to neighborhood immigrant concentration the logged EBV antibody levels decreased by 0.27 AU/ml ($P<0.05$). However, in model 2, we tested the moderating effect of nativity and found the effect was only significant for Latino adults who were foreign-born ($b=-0.37$, $P<0.05$). In models 3–4, we examined the associations between the categorical measure of the number of waves the participant lived in an immigrant enclave (in which 40% or more of the residents in the census tract were foreign-born) over the transition from adolescence to adulthood and immune function (model 3), and the extent to which nativity moderated this association (model 4). In model 3, we found a significant protective effect of neighborhood exposure to an immigrant enclave for only those who lived in an enclave at all 4 waves ($b=-0.15$, $P<0.05$). Consistent with models 1–2, when we interacted the association by nativity, we found the negative association of living in an immigrant enclave at all four waves and EBV antibody levels was significant only for foreign-born Latinos ($b=-0.22$, $P<0.05$). Thus, the analyses offer strong evidence of a

protective association between cumulative immigrant concentration and immune function, but only for foreign-born Latinos.

Discussion

The findings of the analysis offer evidence that exposure to immigrant concentration across the transition from adolescence to adulthood enhances immune function for foreign-born Latinos as captured by lower levels of EBV viral reactivation. Immune function plays a critical role in reducing susceptibility to cancer as well as infectious and chronic disease,[5–7] and our findings support the hypothesis that this may be one mechanism through which neighborhood immigrant concentration contributes to positive health outcomes for foreign-born Latinos. Immigrant enclaves are hypothesized to reduce stress through a variety of mechanisms, such as enhanced social support,[15–16] beneficial social ecologies promoting conventional use of public space,[17] reduced violence[18–20] and reduced exposure to racism[21] – social processes found in prior research to play a direct role in shaping physiological health outcomes. For example, exposure to neighborhood violence was found to be associated with dysregulation of the stress hormone, cortisol[2] and to increases in biomarkers of inflammation (e.g. C-reactive protein, IL-6)[43–45] whereas neighborhoods with low levels of social support were linked to cortisol dysregulation.[3] Research has also found that residence in a neighborhood with higher Latino density may serve as a buffer to the negative physiological effects of discrimination through reduced exposures to racism and/or greater social support when such exposures occur.[21] However, it is important to reiterate that our study found that the health benefits of immigrant concentration for immune function were observed only for those foreign-born adults who lived in an immigrant enclave at all four waves of data collection. These findings suggest that consistent versus episodic exposure is needed for salubrious effects. Unfortunately, Add Health does not provide repeated measures of social organization, discrimination or violence at the neighborhood level nor repeated measures of physiological stress and immune function to test these potential mechanisms as well as more rigorous testing of life course hypotheses (e.g. cumulative and/or developmentally sensitive periods). Consequently, there continues to be an ongoing need for high quality data to explore the possible pathways through which neighborhood contexts may influence health, as well as how exposure to different contexts over time may influence physiological stress and regulation of the immune system.

Consistent with extant research on immigrant enclaves,[22–24] our study found a beneficial relationship between immigrant concentration and immune function only for foreign-born Latinos. With respect to stress-related physiological outcomes, such as immune function, we suggest possible explanations for this differential relationship. First, a *differential exposure* argument would hypothesize that those groups not experiencing an observable benefit of immigrant concentration are not exposed to the mechanisms through which a high prevalence of immigrants confers a salubrious influence. For instance, foreign and U.S. born Latinos may be ecologically integrated but use their neighborhoods in very different ways – e.g., foreign-born residents may be more consistently integrated into local immigrant institutions by comparison with U.S. born residents, resulting in different outcomes across groups. Furthermore, U.S. born Latinos may be more likely than foreign-born Latinos to leave the immigrant enclave on a routine basis for employment or socialization which may

expose them to increased discrimination. Alternatively, an *effect heterogeneity* argument would contend that equivalent neighborhood exposures result in different outcomes by group. For example, foreign and native born residents may both experience exposure to institutions and sources of social support in high concentration immigrant communities, but only foreign-born residents experience their benefits – e.g., due to the role of a strong sense of ethnic identity or bilingual skills.[46] Further research is needed exploring the multiple contexts to which U.S. and foreign-born Latinos are exposed, and their experience within these contexts to better understand the effect of place on Latino health over the life course.

Several limitations to this study warrant discussion. First, our outcome measure – immune function was only measured at wave 4, thus we were unable to capture the dynamics between neighborhood exposures and immune function. To date, few population-based studies have collected longitudinal biomarker data with a particular paucity in evaluations of reactivation of latent herpes viruses over time. To advance the science on chronic stress, research investigating changes in physiological measures over time is needed to better understand the etiology of disease processes, and to develop interventions earlier in the life course to prevent disease onset. Second, Add Heath only includes information on the neighborhood of residence that corresponds to the wave of data collection, thus information on other neighborhoods the participants may have lived in between waves may not be captured. Furthermore, information on the number of moves between waves is only available through wave 3 and the duration of residence in each neighborhood is unknown except for those participants who never moved. Statistical procedures to analyze complex multilevel and longitudinal data are rapidly advancing, thus future data collection efforts should consider collecting more precise data on residential histories when possible. Third, our study examines Latinos as a homogenous group without consideration of potential variation in the relationships by country of origin. Although Add Health contains a diverse sample of participants with respect to country of origin, only 20% of our sample was foreign born (n=223) and of these the majority were Mexican (42%), Cuban (20%), or Central/South American (22%). Analyses of cross-level interactions between immigrant concentration and individual level foreign born status by country of origin would require further disaggregation resulting in prohibitively small sample sizes for reliable parameter estimation. Future studies with sufficient statistical power should consider analyses by county of origin and immigrant generation to examine potential variation within the Latino population. Fourth, consistent with extant neighborhood research, selection bias can be a limitation if healthier Latinos migrate to the U.S. and to immigrant enclaves. Unfortunately, a more rigorous investigation of selection processes would require longitudinal data on EBV, which is currently unavailable in large-scale, longitudinal probability studies. However, the analyses partially address the selection concern by examining cumulative exposures. If the healthy migrant hypothesis was responsible for the observed associations, we would not expect increased duration of exposure to high immigrant concentration communities to exert additional influence on the outcome (unless healthier migrants were more likely to remain in enclaves for a longer period of time). The healthy migrant hypothesis would also be consistent with observing a spurious beneficial effect of exposure to immigrant concentration during adolescence (which we did not find in supplementary analyses of exposures during adolescence and young adulthood) under the assumption that

better health would be observed closer to the time of migration. Last, our study is limited to "neighborhood" exposures occurring at the level of the census tract without consideration of the multiple contexts to which individuals are exposed that most likely play a role in shaping health and behaviors. Consequently, research using a variety of data collection techniques, such as global positioning systems, ecological momentary assessment, surveys, systematic social observation, administrative data (e.g. census data, area resource files) and qualitative interviewing are needed to better capture exposures over space and time and their meaning to enhance our understanding of the role of context in shaping health outcomes.[47]

Despite these limitations, this study is among the first to examine the effects of neighborhood immigrant concentration during the transition from adolescence to adulthood on adult immune function. Our findings highlight directions for future research as well as the need for the collection of rich multilevel and longitudinal data sources. Immune regulation is vital for salubrious health across the life course, and a better understanding is needed of "which", "how" and "under what conditions" contextual exposures impact immune function to promote health across the life course.

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Table 1

Characteristics of the Study Sample,[1] EBV seropositive Latino adults in the Add Health Study, waves 1–4, N=1130

	Mean (SD)	Range
Age, w1	15.6 (1.6)	12–20
Male	0.45 (0.50)	0–1
U.S. born	0.80 (0.40)	0–1
Lived in two biological parent household, w1	0.58 (0.49)	0–1
Highest level of parent education, w1		
Less than high school	0.46 (0.50)	0–1
High school degree	0.23 (0.42)	0–1
Some college	0.20 (0.40)	0–1
College degree or more (reference)	0.11	0–1
Participant college degree, w4	0.24 (0.42)	0–1
Proportion receiving public assistance, w1–4	0.16 (0.23)	0–1
Number of times moved, w1–3	1.47 (1.74)	0–10
Number of subclinical symptoms in past week, w4	0.47 (0.72)	0–3
Number of infectious or inflammatory diseases, w4	0.39 (0.66)	0–3
Average Individual Exposure to Neighborhood Characteristics, w1–4		
Immigrant concentration	0.28 (0.20)	0–0.84
Public assistance	0.07 (0.05)	0–0.32
Residential stability	0.58 (0.17)	0.03–0.94
Number of Waves of Individual Exposure to an Immigrant Enclave		
Exposed at all four waves	0.12 (0.32)	0–1
Exposed at any three waves	0.07 (0.26)	0–1
Exposure at any two waves	0.10 (0.30)	0–1
Exposed at one wave only	0.17 (0.38)	0–1
Never exposed	0.54 (0.50)	0–1

[1] Unweighted analyses

Table 2

Multilevel linear regressions on the associations between individual exposure to neighborhood immigrant concentration during the transition from adolescence to adulthood and EBV antibodies among EBV seropositive Latino adults, Add Health waves 1–4, N= 1130[1]

	Model 1 b	Model 2 b	Model 3 B	Model 4 b
Level I Individual Measures				
Age, w1	0.01	0.02	0.02	0.02
Male	−0.23***	−0.23***	−0.23***	−0.23***
U.S. born	0.01	−0.0001	0.01	0.02
Lived in two biological parent household, w1	0.04	0.04	0.04	0.04
Highest level of parent education, w1				
Less than high school	−0.04	−0.04	−0.04	−0.04
High school degree	−0.06	−0.05	−0.05	−0.06
Some college	−0.07	−0.07	−0.06	−0.06
College degree or more (reference)				
Participant college degree, w4	−0.003	−0.004	−0.002	−0.006
Proportion receiving public assistance, w1–4	0.08	0.08	0.09	0.08
Number of times moved, w1–3	−0.005	−0.005	−0.005	−0.005
Number of subclinical symptoms in past week, w4	−0.01	−0.01	−0.01	−0.01
Number of infectious or inflammatory diseases, w4	0.001	0.001	0.001	0.002
Averaged Individual Exposure to Neighborhood Characteristics, w1–4				
Immigrant concentration	−0.27*	−0.37*		
Poverty concentration	−0.05	−0.03	−0.16	−0.14
Residential stability	−0.08	−0.08	−0.08	−0.08
Interaction: Immigrant concentration X U.S. born		0.15		
Number of Waves of Individual Exposure to an Immigrant Enclave				
Exposed at all four waves			−0.15*	−0.22*
Exposed at any three waves			−0.02	0.11
Exposed at any two waves			−0.08	−0.07
Exposed at one wave only			−0.07	−0.03
Never exposed (reference)				

	Model 1 b	Model 2 b	Model 3 B	Model 4 b
Interaction: Exposed at all four waves x US born				
Interaction: Exposed at any three waves x US born				0.12
Interaction: Exposed at any two waves x US born				−0.18
Interaction: Exposed at one wave only x US born				−0.004
Level 2 Neighborhood Measures				−0.05
Random Intercept	4.96***	4.99***	4.99***	4.99***

[1] All models unweighted, adjusted for the Add Health sampling stratification variables and wave 1 neighborhood clustering

*** P<0.001,

** P<0.01,

* P<0.05