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Pathways from neighborhood poverty to depression among older adults

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Abstract

The pathways through which neighborhood poverty can affect resident depression are still unknown. We investigated mechanisms through which neighborhood poverty may influence depression among older adults. Participants were drawn from the New York City Neighborhood and Mental Health in the Elderly Study II, a 3-wave study of adults aged 65–75 (n=3,497) at baseline. Neighborhood poverty and homicide were associated with depressive symptoms at follow-up waves (RR:1.20, 95%CI: 1.05, 1.36; RR: 1.09, 95%CI: 1.02, 1.17, respectively). Homicide accounted for 30% of the effect of neighborhood poverty on depressive symptoms. Neighborhood exposure to violence may be a key mechanism through which neighborhood poverty influences depression among older adults.

Keywords

neighborhood poverty; older adults; depression; crime

INTRODUCTION

Depression is a common disorder, affecting 120 million people worldwide (Mathers, Fat et al. 2008). It is currently the third leading cause of global disease burden and projections suggest that by 2030 unipolar depressive disorders will grow to be the leading cause of global disease burden (Mathers, Fat et al. 2008). Depression among older adults is

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particularly concerning (Kessler, McGonagle et al. 1994, Beekman, Copeland et al. 1999, Djernes 2006), as it is associated with increased disability, physical illness, cognitive decline, and reduced overall quality of life and satisfaction (Palsson and Skoog 1997, Lenze, Rogers et al. 2001, Charney, Reynolds et al. 2003).

A number of studies suggest that the physical and social environments in which people live have an important influence on their mental health (Evans 2003, Truong and Ma 2006, Aneshensel, Wight et al. 2007, Galea, Ahern et al. 2007, Yen, Michael et al. 2009). In particular, studies have consistently linked negative neighborhood-level economic characteristics such as poverty, disadvantage, inequality, and residential instability to higher risk of depression and depressive symptoms (Ross 2000, Silver, Mulvey et al. 2002, Latkin and Curry 2003, Kubzansky, Subramanian et al. 2005, Galea, Ahern et al. 2007, Beard, Cerdá et al. 2009). Older adults may be especially susceptible to depression due to neighborhood poverty because they are on average less mobile than their younger counterparts. Limited mobility makes older adults more dependent on local amenities and services and on local sources of social support (LaGrange, Ferraro et al. 1992, Whitley and Prince 2005). Indeed, multiple studies found that older adults living in neighborhoods with higher rates of poverty had higher rates of depression (Ostir, Eschbach et al. 2003, Kubzansky, Subramanian et al. 2005, Aneshensel, Wight et al. 2007, Beard, Cerdá et al. 2009).

However, the pathways through which neighborhood poverty can shape older adult depression are still unknown. There may be individual level and neighborhood level mechanisms through which neighborhood poverty impacts depression. There are two potential pathways at the individual level through which neighborhood poverty may influence depression. First, people who live in poor neighborhoods are exposed to more stressful life events, such as unemployment (McLeod and Kessler 1990) and direct experiences of victimization and witnessing violence (Sampson, Raudenbush et al. 1997). Further, stressful life events have been linked to depression among older adults (Kraaij, Arensman et al. 2002). For example, a study among older adults found that those suffering from financial hardships were more likely to be depressed compared to older adults with fewer financial hardships (Krause 1987). Second, poor neighborhoods may lack amenities that are supportive of social organization and social engagement, such as churches and community centers (Altschuler, Somkin et al. 2004, Kim 2008). A lack of social organization and social engagement can lead to isolation, which has also been shown to increase the risk of depression (Glass, De Leon et al. 2006, Echeverría, Diez-Roux et al. 2008). For example, results from a cohort study of approximately 2,000 older adults aged 65 years and older from the New Haven Established Populations for the Epidemiologic Study of the Elderly found that social engagement was associated with lower depression scores after adjustment for various demographic characteristics, physical activity and functional status.

There are also several pathways at the neighborhood level through which poverty can influence older adult depression. First, neighborhoods characterized by higher levels of poverty have lower levels of social cohesion and social control and higher levels of crime and physical disorder (Krivo and Peterson 1996, Sampson, Raudenbush et al. 1997, Cohen,

Farley et al. 2003). Higher levels of crime and physical disorder may generate fear and stress among residents, while lower levels of cohesion and control can result in reduced trust and potentially hamper efforts to reduce crime and physical disorder (Sampson and Groves 1989, Sampson and Laub 1990). Additionally, lower levels of social cohesion and social control can hinder the social support necessary to cope with the fear and stress induced by higher levels of crime and physical disorder (Sampson and Groves 1989, Sampson and Laub 1990). Fear and stress are known causes of depression (Hammen 2005). Second, areas of increased poverty often also have less access to green space and lower levels of walkability. Lower levels of social cohesion, green space, and walkability, and higher levels of crime and physical disorder have all been shown to increase the risk of depression in general and among older adults (Sampson, Morenoff et al. 2002, Latkin and Curry 2003, Whitley and Prince 2005, Berke, Gottlieb et al. 2007, Curry, Latkin et al. 2008, Echeverría, Diez-Roux et al. 2008, Lee and Maheswaran 2011). One cross-sectional analysis among adults aged 45–84 found that lower levels of aesthetic quality and lower levels of social cohesion were associated with higher average depression scores for men and women, controlling for age, income, education, and race/ethnicity. Additionally, higher levels of violence were also associated with higher average depression scores (Mair, Roux et al. 2009). In addition, a study of men aged 65 and older found a significant association between neighborhood walkability and depressive symptoms after adjustment for income, physical activity, education, smoking status, living alone, age, ethnicity, and chronic disease (Berke, Gottlieb et al. 2007).

These individuals and neighborhood factors that impact depression can be explained by a stress-vulnerability model in which environmental factors can potentially work in three ways: 1) by directly influencing the likelihood of experiencing personal stressors (e.g. unemployment, violence, fear, physical disorder); 2) by providing resources to cope with such stressors (e.g. amenities that are supportive of social organization and social engagement); or 3) by influencing the effect of individual-level factors (e.g. an increase of crime may lead to a perceived unsafe environment which in turn increases depressive symptoms).

Understanding the links between neighborhood poverty and depression is critical if we are to identify intervention targets to reduce rates of depression among older adults. If for example, the relationship between neighborhood poverty and depression is explained by increased crime, interventions aimed at lowering levels of crime may also help reduce the risk of depression. To our knowledge, no previous longitudinal study has examined potential mediators of the relationship between neighborhood poverty and depression among older adults. Previous cross-sectional studies found that a variety of neighborhood level factors such as socioeconomic composition, racial composition, demographic composition, and the physical and social environment influence older adult health (Yen et al. 2009). In addition, while a majority of the cross-sectional studies found that neighborhood-level SES was the most consistent and strongest predictor of a variety of outcomes, including depression, a majority of them did not examine the specific neighborhood features or individual features that may aid in understanding the influence of neighborhood SES on health. In cross-sectional studies it is difficult to ascertain the directionality of the relationship between neighborhood poverty and health; a longitudinal framework is better suited to establish a

temporal pathway and thus examine whether specific neighborhood and individual features mediate the effect of neighborhood poverty on depression. Hence, building on previous cross-sectional studies, this study aimed to examine the direct and indirect associations between neighborhood-level poverty and subsequent depressive symptom severity among older adults using longitudinal data from the New York City Neighborhood and Mental Health in the Elderly Study II (NYCNAMES II). We hypothesized that higher levels of neighborhood poverty would increase risk for depressive symptom severity. Additionally, we hypothesized that the relationship between neighborhood poverty and depression would be mediated by various individual and neighborhood-level factors, including stressful life events, household income, social engagement, homicide rate, neighborhood physical and social disorder, walkability, and green space.

METHODS

Study Participants

Study participants were drawn from the New York City Neighborhood and Mental Health in the Elderly Study II (NYCNAMES II), a 3-year longitudinal study of elderly residents, 65 to 75 years of age, of New York City (NYC). Data collection spanned from June 2011 to November 2013. Detailed methods used to sample study participants have been described elsewhere (Mooney, Joshi et al. 2015, Joshi, Mooney et al. 2016). Briefly, census tracts in NYC were divided into 16 strata, representing a broad range of racial-ethnic mix, household income, and walkability. Within each stratum, participants were sampled from a geocoded telephone list from InfoUSA. Each telephone number in each neighborhood had an equal probability of being selected. Interviews were conducted using a computer-assisted telephone interview and the DOT interviews two samples. At wave 1, 3,497 individuals were interviewed, follow-up rates for wave 2 and wave 3 were 78% and 67%, respectively. This study focused on the 2,023 subjects with complete data for all 3 waves of follow-up. The study was approved by the Institutional Review Boards of Columbia University, New York Academy of Medicine and Abt SRBI.

Measures

Outcome: Depression—Past month depression symptom count was measured using the Patient Health Questionnaire (PHQ-9), a 9-item symptom severity rating scale for depression (Spitzer, Kroenke et al. 1999). The PHQ-9 has excellent internal consistency, test-retest reliability, and construct validity (Martin, Rief et al. 2006) and has also been found to produce similar results when administered on the telephone. For the analysis, a depressive symptom severity score, ranging from 0–27, was estimated at baseline, wave 2, and wave 3 of the study.

Exposure: Neighborhood Poverty—Subject's addresses were geocoded using GeoSupport and DCP-Lion, geocoding applications developed by the New York City Department of City Planning. We defined a study participant's neighborhood as a 1-kilometer (km) network buffer, or the area an individual could cover walking 1-km along the pedestrian-accessible street network from his or her home address. Neighborhood poverty was defined as the percent of households in each participant's 1-km network buffer living

below the federal poverty level using the American Community Survey 5-year estimates from 2006–2010.

Mediators

Neighborhood-level—We tested several potential neighborhood-level mediators, including self-reported and recorded measures of neighborhood safety and disorder (i.e. homicide rate, perception of safety, pedestrian and bicyclist injuries and fatalities, neighborhood physical disorder), self-reported measures of neighborhood social cohesion, and locations of green space and geographic measures of walkability.

We downloaded homicide data from the New York Times homicide map and used kernel density methods to spatially interpolate a homicide rate across the city; a 1-year rate of homicides/100,000 persons living within the 1-km network buffer was used for analysis (Times). We treated the sum of pedestrian—motorist injuries, pedestrian—motorist fatalities, bicyclist—motorist injuries, and bicyclist—motorist fatalities to which police were dispatched in each participant’s 1-km network buffer in 2010 as a measure of danger from automobiles. We measured neighborhood physical disorder by virtual street audit using the Computer Aided Neighborhood Visual Assessment System (CANVAS)(Quinn, Mooney et al. 2014, Bader, Mooney et al. 2015) to assess a sample of Google Street View imagery from 532 street segments across New York City dating from 2007–2011. The 532 street segments were chosen in a 2.0 km grid to ensure coverage of New York City as a whole, with 1.0 km and 0.5 km grids overlaid in more densely populated neighborhoods to increase precision there. The spatial sample is described in more detail in Mooney et al 2014. (Mooney, Bader et al. 2014). We used nine audit items to estimate a latent level of physical disorder, and a raster surface estimating disorder across the city was constructed using ordinary kriging (Bader and Ailshire 2014, Mooney, Bader et al. 2014, Quinn, Mooney et al. 2014). Next, we estimated an objective physical disorder level for each subject’s neighborhood by geographically intersecting the 1 km network buffer with the disorder surface. We measured social cohesion and perception of safety through a self-report survey, in which study participants responded to questions about their neighborhood defined as a 15-minute walk from home. Social cohesion was measured using a 7-item survey, asking respondents in reference to the past 12 months questions about their neighborhood such as “if there are problems around your neighborhood, your neighbors get together to with it”, “your neighborhood is close-knit”, “people in your neighborhood generally don’t get along with each other”, etc. Perception of safety was measured using a 6-item survey, asking respondents questions in reference to the past 12 months about their neighborhood such as “my neighborhood streets are well lit at night”, “people riding bikes/walking can be easily seen by people in their homes”, “I see and speak to other people when I am walking in my neighborhood” etc. For both measures each question was rated from 1(strongly agree)-4(strongly disagree) and mean score was used for analysis, ranging from 1–4. Cronbach’s alpha for this scale was 0.75. For each participant, we computed the average social cohesion score reported by other subjects whose home addresses fell in the participant’s 1-km network buffer. We defined green space as the percent of each participant’s 1-km buffer that fell within a large park, hereinafter described as ‘large parks’. We defined walkability as the sum of z-scores of: (1) residential population density (density

of population per total residential land area), (2) land use entropy calculated from the distribution of building floor area among five land use types (education, entertainment, residential, retail, and office), (3) intersection density, (4) retail floor area ratio (the ratio of retail building floor area to retail land area), and (5) subway stop density (Neckerman, Lovasi et al. 2009).

Individual-level—We also accounted for potential individual-level mediators including household income, social engagement and stressful life events. We categorized income into four categories: less than or equal to \$20,000, more than \$20,000 to \$40,000, more than \$40,000 to \$80,000, and more than \$80,000. We measured social engagement with a ten-item scale, asking respondents how frequently (“often”, “sometimes”, or “never”) in the past 30 days they participated in activities such as going out to a movie, preparing meals and attending senior centers. A standardized summary score was used for analysis (de Leon, Glass et al. 2003). Cronbach’s alpha for this scale was 0.83. The number of stressful life events was measured with a six-item survey asking respondents if various stressful events (e.g. “did you get divorced or separated from your spouse or mate?”, “did your spouse or mate become seriously ill”) occurred in the past 12 months (Boardman, Finch et al. 2001). Cronbach’s alpha for this scale was 0.60.

Other covariates

We also accounted for measures of demographic and psychosocial factors that have been found to be associated with poverty and depression. Demographics variables included sex, age, education (less than high school, high school/GED, some college, and Bachelor’s or more), race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, and Other). We included a measure of the personality trait neuroticism, because many longitudinal studies have suggested neuroticism predicts depression (De Graaf, Bijl et al. 2002). This covariate was measured by the short arm of the Eysenck Personality Questionnaire Brief Version (Sato 2005).

Data Analysis

We conducted a repeated measures analysis utilizing generalized estimating equations with a log link function to estimate the relative risk of depressive symptom severity at waves 2 and 3 associated with poverty at wave 1, assuming a Poisson distribution for symptom count. We estimated the total effect of poverty on subsequent depressive symptom severity with a model including baseline depressive symptom severity, demographic characteristics (i.e. sex, race, income and education) and neuroticism. In order to assess mediation, each potential individual and neighborhood-level mediator was added into the model individually (individual-level: social engagement, stressful life events, income; neighborhood-level: homicide rate, perception of safety, pedestrian and bicyclist injuries and fatalities, neighborhood physical disorder, social cohesion, walkability, and large parks).

We evaluated the percentage of the neighborhood poverty effect explained by the above-mentioned potential mediators. This percentage was calculated as follows: $([\exp(\tau) - \exp(\tau')]/[\exp(\tau) - 1]) \times 100$, where $\exp(\tau)$ was the risk ratio (RR) for the neighborhood poverty effect without any potential mediator in the model and $\exp(\tau')$ was the RR for the

neighborhood poverty effect with each potential mediator in the model independently. All neighborhood-level variables (poverty and potential mediators) were rescaled by subtracting the median and dividing by the interquartile range (IQR). This approach helps improve comparability between the measures, so that the risk ratios represent associations with a difference in the interquartile range of each variable and prevents bias due to non-differential measurement error in aggregated measures (Mooney, Richards et al. 2014). Sample weights were created based on the 2006–2010 American Community Survey 5 Year Estimates to adjust for non-coverage and non-response and to align the total sample to the population benchmarks for gender, race/ethnicity, education and geographic location. IVEWARE was used to multiply impute missing covariate data using all available survey responses for the imputation (Raghunathan, Solenberger et al. 2002). Rubin's rules were used to synthesize results across five imputed datasets (Rubin 2009). All analyses accounted for sampling weights and clustering (at the neighborhood level) using robust standard errors, and were conducted using SAS version 9.3 (SAS Institute, Inc., Cary, North Carolina) (1999).

RESULTS

Individual and neighborhood characteristics of the study participants at baseline are shown in Table 1. A majority of the sample was female (61%), Non-Hispanic White (47%), had an income of less than or equal to \$40,000 (60%), and had at least a high school education or equivalent (55%). The associations between neighborhood poverty, the individual level mediators, and depression are shown in Table 2. In the first model, controlling for demographics, baseline depression and neuroticism, individuals living in areas with higher neighborhood poverty had a higher risk of greater depressive symptom severity (Risk Ratio (RR): 1.20, 95% Confidence Interval (CI): 1.05–1.36).

Individual-level mediators

Stressful life events were associated with a higher risk of greater depressive symptom severity (Table 2, Model 2: RR: 1.13, 95% CI: 1.05–1.21). Social engagement and individual income were not associated with depressive symptom severity. However, no individual level factors were found to mediate the relationship between neighborhood poverty and depression. In all models, there was also a consistent association of neuroticism with depression (RR: 1.92, 95% CI: 1.68–2.18).

Neighborhood level mediators

The association between neighborhood poverty and depression and the neighborhood-level mediators is shown in Table 3. Higher homicide rate per 100,000 persons (75th vs 25th percentile) was associated with 1.09 times the risk of increased depressive symptoms (RR: 1.09, 95% CI: 1.02–1.17) and partially mediated the association of neighborhood poverty with depressive symptom severity (RR: 1.14 95% CI: 1.00–1.31). Homicide rate accounted for 30.0% of the association of neighborhood poverty with depression. Large parks were associated with an increased risk of depressive symptom severity (RR: 1.07, 95% CI: 1.01–1.14), however large parks did not mediate the relationship between neighborhood poverty and depression. Walkability, pedestrian-bicyclist injuries and fatalities, neighborhood physical disorder, perception of safety and social cohesion were not associated with

depressive symptom severity and did not mediate the relationship between neighborhood poverty and depression.

DISCUSSION

In this longitudinal study of older adults, we found that neighborhood violence was a key mechanism through which neighborhood poverty shaped the risk of depression among older adults. Neighborhood poverty was positively associated with depressive symptom severity among the elderly. Older adults who experienced a greater number of stressful life events, lived in neighborhoods with a higher homicide rate, or lived in neighborhoods with a greater percentage of large parks in New York City experienced greater depressive symptom severity than those who did not. Among the neighborhood conditions measured, only living in a neighborhood with a higher homicide rate partially mediated the relationship of neighborhood poverty with depression.

Our findings on the relationship between neighborhood poverty and depression are consistent with previous literature; many studies have found that living in poor neighborhoods increases the risk for depression and depressive symptoms (Ross 2000, Silver, Mulvey et al. 2002, Latkin and Curry 2003, Kubzansky, Subramanian et al. 2005, Galea, Ahern et al. 2007, Beard, Cerdá et al. 2009). To our knowledge, this is one of the first studies to reveal the role neighborhood violence plays in mediating the association between neighborhood poverty and depression among older adults, and one of the first studies to examine the relationship between objectively-measured sources of neighborhood violence and depression. This pathway is consistent with previous research that has linked an increase in crime to depression (Sampson and Groves 1989, Latkin and Curry 2003, Kubzansky, Subramanian et al. 2005), and in line with social stress theory, suggests that the effect of neighborhood poverty on depression functions partly through exposure to major area-level stressors such as violence (Wheaton 1983, Wheaton 1985).

We also observed that a greater percentage of land area devoted to large parks within participants' 1km network buffer was associated with an increase in depressive symptom severity. Our findings are in contrast with a review study between green space and health that concluded that most studies found a beneficial effect of green space on health. (Lee and Maheswaran 2011) However, the review noted that most studies used weak measures of green space and further research was needed to uncover the relationship (Lee and Maheswaran 2011). Individuals living in 1-km network buffers that include a higher percentage of parks may lack access to other amenities that might be beneficial for mental health. This finding may also have arisen by chance or may be an artifact of residual confounding.

Study findings should be taken in light of the following limitations. First, we examined depressive symptoms with a validated instrument, rather than a clinical diagnosis of depression. Second, while we controlled for various measures related to poverty and depression, there may still be confounding due to unmeasured or imperfectly measured co-factors. Third, our study had low response and cooperation rates. However, our sample was demographically representative of the 2010 U.S. Census population aged 65 to 75 in New

York City after the use of sample weights. Lastly, our sample was recruited through a geocoded telephone list provided by InfoUSA, which does not include mobile cell phone numbers. However, the National Center for Health Statistics reports that in 2010 (at the start of the survey), only 3.7% of Americans over the age of 65 lived in cell phone-only households.

Notwithstanding these limitations, the results suggest that older adults living in high-poverty urban neighborhoods are at greater risk for depression. Living in areas with higher homicide rates may partially explain the relationship between urban neighborhood poverty and depression. The findings suggest that investment in violence prevention in high-poverty neighborhoods will not only reduce violence, but may also have secondary benefits by improving mental health in the most vulnerable neighborhoods. Additional research is needed to identify alternate mechanisms in the pathway between neighborhood poverty and depression. Characterization of these mechanisms can inform interventions to reduce depression risk in urban neighborhoods.

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Highlights

- Older adults living in high-poverty urban neighborhoods are at greater risk for depression.
- Older adults who experienced a greater number of stressful life events, lived in neighborhoods with a higher homicide rate experienced greater depressive symptom severity than those who did not.
- Neighborhood exposure to violence may be a key mechanism through which neighborhood poverty influences depression among older adults.

Table 1

Individual and Neighborhood Characteristics of NYC NAMES participants at baseline who completed all three waves

		M(SE)	N(%)
Age		70.15(2.95)	
Gender	Male		790(39.13)
	Female		1232(60.87)
Race	Non-Hispanic White		1040(47.45)
	Non-Hispanic Black		552(24.24)
	Hispanic		283(16.10)
	Other		115(12.22)
Income	Less than or equal to \$20,000		573(35.05)
	More than \$20,000 to \$40,000		418(25.67)
	More than \$40,000 to \$80,000		379(20.37)
	More than \$80,000		367(18.90)
Education	< High school		318(26.23)
	High school/GED		526(28.95)
	Some college		348(16.35)
	BA/graduate work		819(28.46)
Depression	Wave 1 Depression Symptom Severity	1.95(3.44)	
	Wave 2 Depression Symptom Severity	1.96(3.46)	
	Wave 3 Depression Symptom Severity	2.01(3.54)	
Homicide Rate		0.26(0.82)	
Walkability		0.07(2.99)	
%Poverty		0.16(0.10)	
Stressful life events		0.82(1.02)	
Neuroticism		1.40(0.49)	
Social engagement		8.40(3.56)	

Notes: All neighborhood variables are at the 1-km buffer; Depression symptom severity range 0–27; homicide rate 1-year rate/100,000 persons; Stressful life events range 0–12; Neuroticism 0–12; Social engagement 0–22.

Neighborhood poverty, individual-level characteristics and depression symptom severity, NYCNAMES participants June 2011–November 2013

Table 2

	Baseline Model (1)	Social Engagement Model (2)	Stressful Life Events Model (3)	Income Model (4)
	RR (95%CI)	RR (95%CI)	RR (95%CI)	RR (95%CI)
Neighborhood % poverty	1.20 (1.05, 1.36)	1.20 (1.05, 1.36)	1.19 (1.05, 1.35)	1.18 (1.03, 1.34)
Baseline depression	1.09 (1.07, 1.11)	1.09 (1.07, 1.11)	1.09 (1.07, 1.11)	1.09 (1.07, 1.11)
Sex				
Female			<i>ref</i>	
Male	0.86 (0.73, 1.00)	0.84 (0.72, 0.99)	0.83 (0.70, 0.97)	0.87 (0.75, 1.02)
Race				
Non-Hispanic White			<i>ref</i>	
Non-Hispanic Black	0.96 (0.78, 1.20)	0.96 (0.78, 1.19)	0.95 (0.77, 1.19)	0.94 (0.76, 1.16)
Hispanic	1.02 (0.80, 1.30)	1.01 (0.79, 1.28)	1.02 (0.80, 1.28)	0.97 (0.76, 1.25)
Other	1.15 (0.87, 1.52)	1.15 (0.87, 1.52)	1.15 (0.87, 1.52)	1.13 (0.86, 1.49)
Less than high school			<i>ref</i>	
High school/GED	0.83 (0.68, 1.01)	0.84 (0.69, 1.02)	0.82 (0.67, 0.99)	0.87 (0.71, 1.07)
Some college	1.02 (0.82, 1.28)	1.05 (0.84, 1.32)	1.01 (0.81, 1.25)	1.10 (0.87, 1.39)
BA/graduate work	0.71 (0.57, 0.90)	0.74 (0.58, 0.93)	0.72 (0.58, 0.90)	0.77 (0.59, 1.01)
Neuroticism	1.92 (1.68, 2.18)	1.92 (1.70, 2.18)	1.85 (1.62, 2.10)	1.92 (1.68, 2.18)
Social engagement		0.98 (0.96, 1.01)		
Stressful life events			1.13 (1.05, 1.21)	
\$20,000–\$40,000				0.98 (0.77, 1.23)
\$40,000–\$80,000				1.06 (0.76, 1.48)
\$80,000+				1.23 (0.99, 1.52)

Notes: Neighborhood % poverty was rescaled to have an interquartile range of 1; Bolding indicates statistically significant estimates

Table 3

Neighborhood level characteristics and depression symptom severity, NYCNAMES participants June 2011–November 2013

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	RR (95%CI)	RR (95%CI)	RR (95%CI)	RR (95%CI)	RR (95%CI)	RR (95%CI)	RR (95%CI)	RR (95%CI)
Neighborhood % poverty	1.20 (1.05, 1.36)	1.14 (1.00, 1.31)	1.20 (1.03, 1.40)	1.24 (1.08, 1.40)	1.21 (1.06, 1.38)	1.19 (1.04, 1.35)	1.14 (0.97, 1.34)	1.19 (1.02, 1.39)
Homicide Rate		1.09 (1.02, 1.17)						
Disorder		0.97 (0.64, 1.49)						
Walkability			0.92 (0.85, 1.00)					
Pedestrian-Bicyclist fatalities					0.97 (0.89, 1.06)			
Large Parks						1.08 (1.01, 1.15)		
Perception of Safety							1.39 (0.77, 2.48)	
Social Cohesion								1.05 (0.63, 1.77)

Notes: All neighborhood variables were rescaled to have an interquartile range of 1; Bolding indicates statistically significant estimates All models controlled for baseline depression, sex, race, education, and neuroticism;