

# The Impact of Neighborhood Conditions and Psychological Distress on Preterm Birth in African-American Women

Carmen Giurgescu, PhD, RN,<sup>1</sup> Shannon N. Zenk, PhD, MPH, RN,<sup>2</sup> Thomas N. Templin, PhD,<sup>1</sup> Christopher G. Engeland, PhD,<sup>3</sup> Karen Kavanaugh, PhD, RN, FAAN,<sup>4</sup> and Dawn P. Misra, PhD<sup>5</sup>

<sup>1</sup>College of Nursing, Wayne State University, Detroit, Michigan; <sup>2</sup>College of Nursing, University of Illinois at Chicago, Chicago, Illinois;

<sup>3</sup>Department of Biobehavioral Health and College of Nursing, Pennsylvania State University, University Park, Pennsylvania; <sup>4</sup>College of Nursing and Children's Hospital of Michigan, Wayne State University, Detroit, Michigan; and <sup>5</sup>Department of Family Medicine and Public Health Sciences, School of Medicine, Wayne State University, Detroit, Michigan

Correspondence to:

Carmen Giurgescu, College of Nursing, Wayne State University, Cohn Bldg. 368, 5557 Cass Ave., Detroit, MI 48202. E-mail: carmen.giurgescu@wayne.edu

**ABSTRACT** *Objective:* Prior research suggests that adverse neighborhood conditions are related to preterm birth. One potential pathway by which neighborhood conditions increase the risk for preterm birth is by increasing women's psychological distress. Our objective was to examine whether psychological distress mediated the relationship between neighborhood conditions and preterm birth. *Design and Sample:* One hundred and one pregnant African-American women receiving prenatal care at a medical center in Chicago participated in this cross-sectional design study. *Measures:* Women completed the self-report instruments about their perceived neighborhood conditions and psychological distress between 15–26 weeks gestation. Objective measures of the neighborhood were derived using geographic information systems (GIS). Birth data were collected from medical records. *Results:* Perceived adverse neighborhood conditions were related to psychological distress: perceived physical disorder ( $r = .26, p = .01$ ), perceived social disorder ( $r = .21, p = .03$ ), and perceived crime ( $r = .30, p = .01$ ). Objective neighborhood conditions were not related to psychological distress. Psychological distress mediated the effects of perceived neighborhood conditions on preterm birth. *Conclusions:* Psychological distress in the second trimester mediated the effects of perceived, but not objective, neighborhood conditions on preterm birth. If these results are replicable in studies with larger sample sizes, intervention strategies could be implemented at the individual level to reduce psychological distress and improve women's ability to cope with adverse neighborhood conditions.

Key words: African-American, neighborhood conditions, preterm birth, psychological distress.

## Background

In 2013 in the United States, 16.3% of pregnant African-American women had a preterm birth compared with 10.2% of pregnant non-Hispanic White women (Martin, Hamilton, Osterman, Curtin, & Mathews, 2015). Recent attempts to explain this disparity have focused on neighborhood

conditions (Janevic et al., 2010) such as disorder and crime. Neighborhood disorder, defined as “visible cues indicating a lack of order and social control” (p. 413) (Ross & Mirowsky, 2001) in the community, can be both physical (e.g., vacant housing, vandalism) and social (e.g., drug dealing, prostitution) (Ross & Mirowsky, 2001; Skogan,

1990). African-American women are disproportionately exposed to neighborhood disorder and crime (Laraia et al., 2006; Messer, Kaufman, Dole, Herring, & Laraia, 2006a), and these may be a source of considerable stress. There is some evidence that living in these adverse neighborhood conditions may impact African-American women to a greater extent as well. Researchers have found that living in neighborhoods with greater disorder, as measured by housing vacancy rates, was associated with an increased risk of preterm birth in African-American women (Giurgescu et al., 2012; Reagan & Salsberry, 2005). One of these studies included non-Hispanic White women as well but found no relationship in this group (Reagan & Salsberry, 2005). With some exceptions (Giurgescu et al., 2012; Masi, Hawkey, Piotrowski, & Pickett, 2007), research has also shown that African-American women living in neighborhoods with the highest violent crime rates had a higher risk of preterm birth compared to those living in neighborhoods with the lowest violent crime rates (Messer, Kaufman, Dole, Savitz, & Laraia, 2006b; Messer et al., 2006a). While these studies suggest that neighborhood conditions may play a role in the racial disparity in preterm birth for African-American women, not all studies with samples of African-American women found a relationship between objective measures of the neighborhood conditions—specifically disorder and crime—and preterm birth in this population.

One potential explanation for the inconsistency in findings is differences in women's perceptions of neighborhood conditions. Research on the relationship between perceptions of the neighborhood conditions and preterm birth, however, is limited. In a sample of postpartum African-American women, higher levels of perceived neighborhood crime, but not disorder, were related to higher risk of preterm birth (Giurgescu et al., 2012). Dole et al. (2003) found that negative perceptions of neighborhood safety were associated with a slight increase in the risk of preterm birth in a sample of both pregnant African-American and White women. Finally, in African-American women with  $\leq 12$  years of education, higher perceived neighborhood disorder was associated with significantly higher rates of preterm birth (Sealy-Jefferson, Giurgescu, Helmkamp, Misra, & Osypuk, 2015). In

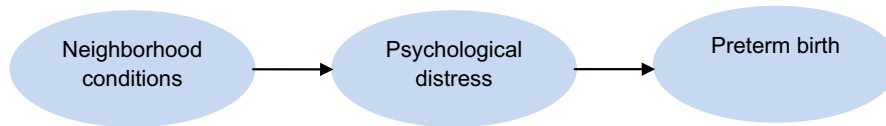
contrast, preterm birth rates were significantly lower with higher perceptions of neighborhood safety for these women (Sealy-Jefferson et al., 2015). Therefore, studies based on perceived neighborhood conditions seem to show associations with preterm birth.

Researchers have proposed that stress is the pathway by which neighborhood disorder and crime affect preterm birth (Messer et al., 2006b), yet little work has explicitly tested this hypothesis. Neighborhood conditions may increase the levels of psychological distress and ultimately increase the risk for preterm birth. Psychological distress has a well-established relationship with preterm birth (Dominguez, Dunkel-Schetter, Glynn, Hobel, & Sandman, 2008; Giurgescu et al., 2012; Messer, Dole, Kaufman, & Savitz, 2005; Misra, O'Campo, & Strobino, 2001). However, research demonstrating to what degree neighborhood conditions contribute to psychological distress is limited. In a recent retrospective study, psychological distress in the last month of pregnancy mediated associations between neighborhood conditions (perceived neighborhood crime, objective social disorder) and preterm birth (Giurgescu et al., 2012). Because of the retrospective design, however, the researchers could not rule out the possibility that women's birth outcomes may have affected their retrospective reports on neighborhood conditions and psychological distress during pregnancy. Thus, prospective studies addressing this issue are warranted.

### ***Research hypothesis***

The current study extends prior research by prospectively examining the effects of neighborhood disorder and crime on preterm birth in a sample of pregnant African-American women (see Figure 1). It was hypothesized that:

1. Neighborhood conditions (e.g., physical disorder, social disorder, crime) increase psychological distress;
2. Psychological distress increases risk of preterm birth; and
3. Psychological distress mediates the effects of neighborhood conditions on preterm birth.



**Figure 1. Hypothesized Pathways between Neighborhood Conditions and Preterm Birth [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]**

## Methods

### *Design and sample*

A prospective design was used with survey data, including women's perceptions of their neighborhoods and psychological distress, collected between 15 and 26 weeks gestation. Objective neighborhood data were obtained from census and other administrative sources. Birth outcome data were collected from medical records.

A sample of 114 self-identified African-American women was enrolled in the study if they (a) were at least 18 years of age; (b) had singleton medically low-risk pregnancy; and (c) were in the second trimester of pregnancy. Only women with low-risk pregnancy were included into the study given that preexisting medical diagnosis (e.g., chronic hypertension, preeclampsia, placenta previa, incompetent cervix) may pose as stressors themselves. In addition, women with high-risk pregnancy are more likely to experience psychological distress and preterm birth; and therefore, were excluded from the study. Women were recruited between 2009 and 2011 from a medical center in Chicago. Six questionnaires were not completed or were lost in the mail and one woman declined participation after signing the informed consent. We were not able to obtain birth data for four other women who changed providers and moved from their addresses. Two women had termination of pregnancy in the second trimester and we did not include them in the analysis. One hundred and one women remained who had both psychological and birth outcome data available for analysis.

Post hoc power for the effect of psychological distress on preterm birth was determined using PASS software (NCSS Statistical Software, Kaysville, UT, USA). Post hoc power analysis uses the obtained effect size and yields an estimate of the sample size needed to achieve conventional power of 80% with two-tailed alpha at  $p = .05$ . For a

continuous measure, the effect size depends on the units of measurement. To simplify interpretation, psychological distress was dichotomized at the median and the odds ratio was computed. The odds of preterm birth given high psychological distress were 10.87 times larger than the odds of preterm birth given low psychological distress. The sample size required to have power = 0.8 and the obtained effect size of 10.87 is 115. Thus, the reported study was only slightly underpowered ( $115 - 101 = 14$ ). With regard to the model, we note that the model had 17 parameters to be estimated and that the parameters to cases ratio of  $101/17 = 5.94 > 5$  is a frequently used guideline (Bentler & Chou, 1987).

The study was approved by the Institutional Review Board at the participating site. Potential participants were contacted first by the health care provider. The principal investigator or research assistants met face-to-face with women before or after their prenatal visit, explained the study, invited them to participate, and completed the informed consent process. The majority of participants completed the packet of questionnaires in a private room in the clinic. Twelve women completed the questionnaires at home and mailed them. Women received \$25 reimbursement for their time and participation. Birth data were collected from the medical records at the participating site. We contacted four women who did not deliver at the medical center in order to obtain the date of birth for the baby. For these four women, the research team calculated the gestational age at birth based on the date of birth provided by the women.

### *Measures*

**Maternal characteristics.** Maternal socio-demographic characteristics such as maternal age, marital status, education, and income were collected from self-report. Obstetrical characteristics such as gestational age at time of data collection and medical history were collected from prenatal medical records.

*Gestational age at birth* was collected from birth records based on the last monthly period and confirmed by ultrasound examination. Preterm birth was classified as births occurring at less than 37 weeks gestation and term birth as births occurring at 37 or more weeks gestation.

*Psychological distress* was measured by the Psychological General Well-Being Index that assesses subjective well-being or distress (Dupuy, 1984). The instrument consists of 22 items on a 6-point scale (*most distress to most positive option*). The sum of the items creates the total score with a possible range of 0 to 110, with some items being reverse-scored. Lower scores represent higher levels of psychological distress. Evidence of concurrent validity had acceptable correlations between the Psychological General Well-Being Index and other depression scales ranging from .52 to .80 (Dupuy, 1984). In the current study, the Cronbach's alpha for the total scale was .94.

*Neighborhood conditions* were assessed using both objective and perceived measures. Neighborhood conditions included physical disorder, social disorder, and crime. Participants' home addresses were geocoded using ArcGIS 9.1 (Redlands, CA, USA) to obtain the corresponding latitude and longitude, and objective neighborhood measures were developed based on a 0.5-mile circular buffer around the home address, which was considered their "neighborhood." We selected a 0.5-mile buffer to capture women's immediate residential environment and because it is a commonly used metric in neighborhood research that is considered superior to administrative units (e.g., census tracts).

Objective physical disorder was measured using two indicators: (a) proportion of vacant housing based on 2010 Census data for census block groups intersecting the neighborhood; and (b) annual number of vandalism incidents based on the Chicago Police Department crime summary data from August 1, 2010 to July 31, 2011. Because these measures are on different scales, z-scores were calculated for each measure and the mean of the two z-scores was used in the analysis.

Objective social disorder was measured as the annual number of prostitution- and drug-related incidents in the neighborhood from the Chicago Police Department crime summary data from August 1, 2010 to July 31, 2011.

Objective violent crime was measured as the annual number of incidents of homicide, sexual assault, aggravated assault, and aggravated battery in the neighborhood using the Chicago Police Department crime summary data from August 1, 2010 to July 31, 2011. Crime incidents rather than crime rates were used, based on the assumption that participants would be most aware of and influenced by crime incidents rather than the risk of violent crime per capita.

Perceived physical disorder was measured based on women's responses to six items (houses in my neighborhood are generally well maintained—reverse coded, heavy car or truck traffic in my neighborhood, my neighborhood has a lot of vacant lots or vacant houses, streets, and sidewalks in my neighborhood are kept clean of litter and dumping—reverse coded, a lot of loud noise from cars or neighbors in my neighborhood) on a 5-point scale (*strongly agree to strongly disagree*) from the Neighborhood Physical Environment Scale (Israel et al., 2006; Schulz, Zenk, Kannan, Israel, & Stokes, 2012). We added one item (My neighborhood has a lot of vandalism) from the Neighborhood Social Environment Scale (Israel et al., 2006). The sum of the six items created a total score (potential range 6–30) with higher scores representing higher levels of perceived physical disorder. Supporting the construct validity of the adapted scale, perceived physical disorder was positively associated with perceived social disorder ( $r = .69$ ) and perceived crime ( $r = .67$ ) in a sample of African-American women (Giurgescu et al., 2012). In the current study, Cronbach's alpha was .77.

Perceived social disorder was measured based on women's responses using four items about neighborhood conditions (In your neighborhood how much problem is: prostitution, gangs, homeless people, drug use/dealing) from the Neighborhood Problems Scale (Elder, Eccles, Ardelet, & Lord, 1995) and two items (people loitering or hanging around, public drinking) adapted from the Perceived Neighborhood Scale (Martinez, Black, & Starr, 2002). The six items are rated on a 3-point scale (*not a problem to a big problem*) with higher scores representing a greater degree of perceived neighborhood problems (potential range of scores 6–18) (Elder et al., 1995; Martinez et al., 2002). Supporting the construct validity of the adapted scale, perceived social disorder was positively

associated with perceived physical disorder ( $r = .69$ ), perceived crime ( $r = .59$ ), and objective social disorder ( $r = .25$ ) in a sample of African-American women (Giurgescu et al., 2012). The Cronbach's alpha for current study was .90.

Perceived crime in the neighborhood was measured based on women's responses to six items (e.g., not safe to walk in the neighborhood at night; friends and relatives do not visit me at home because they do not feel safe; people are scared of being robbed in my neighborhood, people are scared of being raped in my neighborhood, people are scared of being mugged in my neighborhood, or people are scared of being murdered in my neighborhood) from the perceived crime subscale of the Perceived Neighborhood Scale (Martinez, 2000; Martinez et al., 2002). The six items are rated on a 5-point scale (*strongly agree to strongly disagree*) with total score ranging from 6 to 30. Positive correlations between the adapted scale and perceived physical disorder and perceived social disorder in African-American women support construct validity (Giurgescu et al., 2012). In the current study, Cronbach's alpha was 0.90.

### **Analytic strategy**

Data were entered, cleaned, and prepared for analysis on an ongoing basis by the principal investigator or research assistants using SPSS 20 (Chicago, IL, USA). Missing data were less than 5% for questionnaires and less than 10% in objective measures. Missing data were estimated using maximum likelihood under the assumption of missing at random (Schafer & Graham, 2002). Pearson correlation coefficient  $r$  was used to examine linear relationships among the primary study variables: neighborhood conditions, psychological distress, and preterm birth. Independent samples  $t$  test and chi-square were used to examine differences in maternal characteristics and neighborhood conditions between women with preterm birth and women with term birth. Pearson correlation coefficient  $r$  and point biserial correlations were used to examine the relationships of major study variables with maternal characteristics. To estimate the mediating effect of psychological distress, structural equation modeling (SEM) was applied using Mplus version 4.1 (Muthén & Muthén, Las Angeles, CA, USA). SEM is a more direct approach for modeling mediation compared

with multiple logistic regression which requires three regressions analysis to test mediation. Moreover, SEM allows for creating latent variables to represent objective and perceived neighborhood conditions which cannot be included in multiple logistic regression.

## **Results**

### **Maternal characteristics**

The women's mean age was 24 years and the mean gestational age at the time of data collection was 20 weeks. Eighty-four percent of women were single, 52% unemployed, 47% had annual household income of less than \$10,000, and 40% had no college education. Nine women had preterm birth. Four women had a history of preterm birth in prior pregnancies, but none of these women had preterm birth in the current pregnancy. Seven women developed preeclampsia during pregnancy, but they did not have preeclampsia at the time of data collection. Women with preterm birth were more likely to be younger compared to women with term birth. There were no other statistically significant differences in maternal characteristics between women with preterm birth and women with term birth (see Table 1). Psychological General Well-Being Index scores were not related to maternal characteristics of age, education, marital status, living with the father of the baby, employment, household income, BMI, gravida or gestational age at time of data collection. Objective violent crime ( $r = -.025$ ,  $p = .02$ ) and objective physical disorder ( $r = -.24$ ,  $p = .02$ ) were negatively related to household income. Perceived social disorder was negatively related to household income ( $r = -.30$ ,  $p = .003$ ) and education ( $r = -.24$ ,  $p = .01$ ). Similarly, perceived physical disorder was negatively related to household income ( $r = -.33$ ,  $p = .001$ ) and level of education ( $r = -.31$ ,  $p = .002$ ). There were no other relationships between neighborhood disorder or crime and maternal characteristics (data not shown).

### **Relationships among variables**

Correlations among study measures are shown in Table 2. Inspection of these correlations revealed the following: First, the objective measures of neighborhood conditions strongly correlated with each other,  $r$ 's = .69-.89, and only weakly correlated with

TABLE 1. Maternal Characteristics and Neighborhood Conditions (N = 101)

Variables	Term birth (N = 92)	Preterm birth (N = 9)		Mean difference	95% confidence interval
	<i>M (SD)</i>	<i>M (SD)</i>	<i>t</i>		
Age	24.23 (5.45)	20.33 (2.0)	4.448***	3.9	-.25; 7.07
Prepregnancy body mass index	27.65 (7.07)	29.13 (8.73)	-.556	-1.48	-7.95; 2.55
Working hours per week	22.42 (19.51)	10.14 (15.50)	1.609	12.28	-4.59; 25.99
	<i>N (%)</i>	<i>N (%)</i>	$\chi^2$		
Gravida					
Multigravida	65 (70.7)	6 (66.7)	.062		
Primigravida	27 (29.3)	3 (33.3)			
Marital status					
Single	76 (82.6)	9 (100)	1.860		
Married	16 (17.4)	0 (0)			
Living with the baby's father					
No	42 (45.7)	7 (77.8)	3.387		
Yes	50 (54.3)	2 (22.2)			
Education					
Less than high school	12 (13.0)	2 (22.2)	2.436		
Graduated high school	23 (25.0)	3 (33.3)			
Some college	37 (40.2)	3 (33.3)			
Associate degree	6 (6.5)	1 (11.1)			
Bachelor degree	11 (12.0)	0 (0)			
Graduate program or higher	3 (3.3)	0 (0)			
Employment					
No	46 (50.0)	6 (66.7)	.912		
Yes	46 (50.0)	3 (33.3)			
Household income					
Less than \$9,999	43 (49.4)	4 (50.0)	2.316		
\$10,000–19,999	11 (12.6)	1 (12.5)			
\$20,000–29,999	18 (20.7)	3 (37.5)			
More than \$30,000	15 (17.2)	0 (0)			
Smoking during pregnancy					
No	87 (94.6)	9 (100%)	.515		
Yes	5 (5.4)	0 (0%)			
	<i>M (SD)</i>	<i>M (SD)</i>	<i>t</i>		
Objective physical disorder <sup>a</sup>	-.03 (.89)	.081 (1.1)	-.343	-.11	-.74; .52
Percent vacant housing <sup>b</sup>	15.6 (6.3)	16.1 (8.5)	-.212	-.51	-5.28; 4.26
Vandalism <sup>b</sup>	204.2 (77.9)	220.1 (106.7)	-.503	-15.96	-79.03; 47.14
Objective social disorder	348 (390.3)	374 (388.1)	-.194	-26.38	-296; 243
Prostitution <sup>b</sup>	20.70 (48.1)	41.7 (52.9)	-1.097	-21.01	-59.10; 17.08
Drug-related incidents <sup>b</sup>	384.2 (378.7)	392.9 (365.0)	-.058	-8.636	-305; 288
Objective violent crime	182 (118.3)	212 (149)	-.723	-30.56	-114.50; 53.37
Homicide <sup>b</sup>	3.1 (2.6)	4.3 (3.6)	-1.184	-1.25	-3.36; .85
Sexual assault <sup>b</sup>	8.93 (5.9)	8.14 (5.17)	.336	.78	-3.85; 5.42
Aggravated assault <sup>b</sup>	30.4 (19.1)	31.4 (118.9)	-.134	-1.01	-15.95; 13.93
Aggravated battery <sup>b</sup>	63.9 (4.7)	75.3 (19.6)	-.665	-11.31	-45.11; 22.49
Perceived physical disorder	13.97 (5.82)	15.78 (5.76)	-.886	-1.80	-5.83; 2.23
Perceived social disorder	9.61 (3.55)	10.97 (3.61)	-1.102	-1.37	-3.83; 1.09
Perceived crime	12.01 (6.06)	15.22 (5.63)	-1.526	-3.21	-7.39; .96

Notes <sup>a</sup>Calculated as the mean of the standardized scores (z-scores).

<sup>b</sup>Presented based on raw numbers within half a mile from address.

\*\*\* $p < .001$ .

TABLE 2. Relationships among Variables (N = 101)

Variable	Objective physical disorder	Objective social disorder	Objective violent crime	Perceived physical disorder	Perceived social disorder	Perceived crime	Psychological distress
Objective physical disorder	—						
Objective social disorder	.69 <sup>***</sup>	—					
Objective violent crime	.84 <sup>***</sup>	.89 <sup>***</sup>	—				
Perceived physical disorder	.28 <sup>**</sup>	.19	.27 <sup>**</sup>	—			
Perceived social disorder	.16	.15	.14	.70 <sup>***</sup>	—		
Perceived crime	.21 <sup>*</sup>	.07	.13	.60 <sup>***</sup>	.64 <sup>***</sup>	—	
Psychological distress	.05	.05	.09	.26 <sup>**</sup>	.21 <sup>*</sup>	.30 <sup>**</sup>	—
Preterm birth	.08	.11	.15	.07	.08	.14	.25 <sup>*</sup>

\* $p < .05$  two-tailed; \*\* $p < .01$  two-tailed; \*\*\* $p < .001$  two-tailed.

the perceived measures of neighborhood conditions,  $r$ 's = .07 (ns) to .28. Perceived neighborhood disorder and crime also strongly correlated with each other,  $r$ 's = .60–.70. This pattern of correlations suggests the presence of two distinct latent factors, one for *objective* measures of neighborhood conditions and one for *subjective* measures. Hence, we subsequently modeled these variables in this way as two latent neighborhood factors.

Second, only perceived neighborhood conditions weakly correlated with psychological distress: perceived physical disorder ( $r = .26$ ,  $p = .01$ ), perceived social disorder ( $r = .21$ ,  $p = .03$ ), and perceived crime ( $r = .30$ ,  $p = .01$ ). The objective neighborhood conditions did not correlate to psychological distress. Without correlations to objective neighborhood conditions, psychological distress cannot have the mediating effect on preterm birth (Baron & Kenny, 1986) that was predicted by the conceptual model in Figure 1.

In summary, correlations suggested that (a) the neighborhood measures consist of two latent factors: perceived neighborhood conditions and observed neighborhood conditions; and (b) psychological distress is not likely to mediate the effect of objective neighborhood conditions on preterm birth. These features were reflected in the SEM mediation model results.

### **Mediating effect of psychological distress on preterm birth**

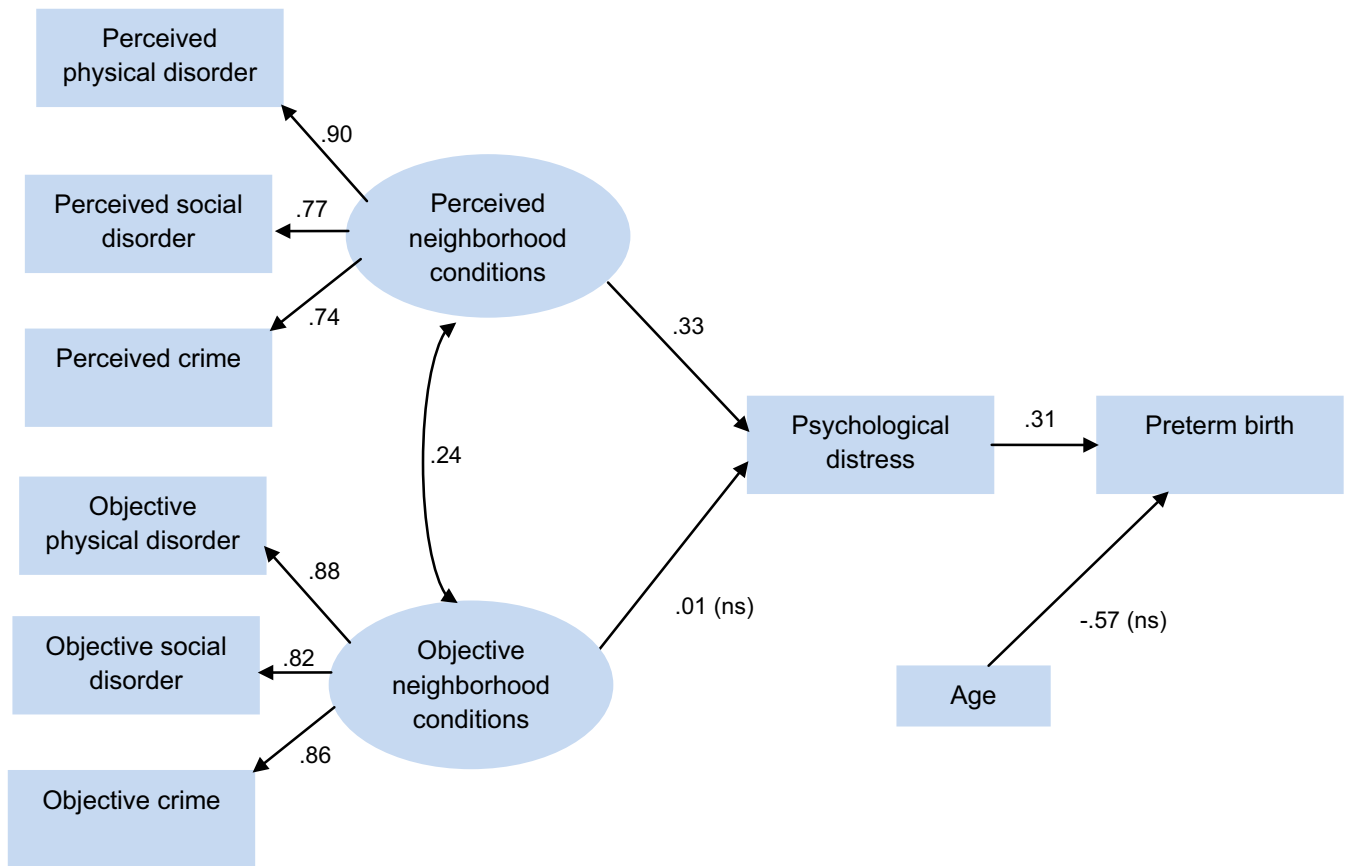
The mediation model results are shown in Figure 2. This was a recursive SEM with two latent constructs (objective and perceived neighborhood conditions) and two endogenous variables (psychological distress, preterm birth), with women's age as an

exogenous covariate. The model was estimated with Mplus 4.1 using categorical variable methodology (CVM). Parameter estimates were obtained using the weighted least squares with mean and variance adjustment estimator (WLSMV) (Muthén, 1993), the default estimation method when categorical endogenous variables are specified. The CVM in Mplus is highly recommended for these kinds of data (Finney & DiStefano, 2006; Newsom, 2012).

The chi-square test of model fit was not significant (Muthén's adjusted  $\chi^2$  (df = 7) = 5.06,  $p = .65$ ), indicating that the model tested with sample data did not differ significantly from a population model with the same parameters. Goodness of fit was assessed using the comparative fit index (CFI) and the root-mean-square error of approximation (RMSEA). The CFI was 1.00; greater than .95 is needed in order to ensure that misspecified models are not accepted (Hu & Bentler, 1999). The RMSEA was zero, indicating exact model fit (Browne & Cudeck, 1993).

The standardized factor loading and path coefficients are shown in Figure 2. As hypothesized (a) psychological distress had a direct effect on preterm birth; (b) perceived neighborhood conditions had a direct effect on psychological distress; and (c) psychological distress mediated the effects of perceived neighborhood conditions on preterm birth (standardized specific indirect effect = .092,  $p < .05$ ). Contrary to our hypothesis, the objective neighborhood conditions were not related to psychological distress. The latent factors were correlated,  $r = .24$ . Age was not significantly related to preterm birth in this model.

The item error variances and equation disturbance terms are not shown in Figure 2; there were



**Figure 2. Pathways between Neighborhood Conditions and Preterm Birth [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]**

The values shown are standardized factor loadings and path coefficients. Path and factor loadings were significant ( $p < .05$ ) except where noted. Overall model fit was excellent: Chi-square = 5.06,  $df = 7$ ,  $p = .63$ , CFI = 1.0, RMSEA = 0.0. The weighted root-mean-square residual was .49.

no correlations among errors and/or disturbances. The error term for the objective crime variable was set to equal  $VAR(\text{objective crime}) * (1 - \text{reliability})$  in order to avoid estimation of a negative error variance (Hayduk, 1987). This reliability was estimated to be the average reliability of the other two indicators (objective physical disorder and objective social disorder).

## Discussion

Pregnant African-American women who reported more adverse neighborhood conditions, specifically greater disorder and crime, during their second trimester also reported higher levels of psychological distress and had higher risk for preterm birth. These results suggest that psychological distress is a potential mechanism by which neighborhood

conditions contribute to preterm birth and concur with a recent retrospective study that reported that psychological distress in the last month of pregnancy mediated the effects of perceived crime on preterm birth in a sample of postpartum African-American women (Giurgescu et al., 2012). Indeed, Miranda, Maxson, and Edwards (2009) suggested that adverse neighborhood conditions are cumulatively stressing African-American women and this cumulative stress may result in disparities in negative birth outcomes.

Other researchers have found that women who lived in neighborhoods with high rates of housing vacancy (Giurgescu et al., 2012; Reagan & Salsberry, 2005) and violent crime (Messer et al., 2006a,b) had higher rates of preterm birth. However, objective measures of neighborhood conditions did not relate to psychological distress



or to preterm birth (directly or indirectly) in the current study. Conversely, perceived measures of neighborhood conditions were related to preterm birth, and this relationship was mediated by measures of psychological distress. One potential explanation is that these findings reflect same source bias: women with higher psychological distress may be more likely to report problems with disorder and crime. It is also possible that neighborhood conditions measured by administrative data (e.g., census, crime reports) do not capture individual exposures to neighborhood disorder and crime (Messer et al., 2006a). Women's perceptions of their neighborhoods may more accurately reflect their personal experiences than objective neighborhood measures. It is also possible that our measurement of "neighborhood" exposure (defined as the 0.5 mile buffer) restricted our ability to precisely capture neighborhood exposures as women may define their neighborhood differently than the imposed buffer. Indeed, researchers have found that objective "activity spaces" differ from individual self-defined neighborhood activity spaces. For example, Perchoux, Chaix, Brondeel, and Kestens (2016) have found that the mean proportion of green space was higher in the perceived residential neighborhood than in the street-network residential buffer (1,000 m street network around each participant's home) (Perchoux et al., 2016). Similarly, Colabianchi et al. (2014) found that the average number of parks in the self-defined neighborhoods was markedly different than average number of parks in the 0.75-mile buffer and the census tract (3.4, 5.2, and 1.4, respectively) (Colabianchi et al., 2014). Zenk et al. (2011) also found that most participants' activity spaces were larger than their residential neighborhoods, suggesting that participants conducted day-to-day activities outside their residential neighborhoods. These results suggest that differences exist between objective and perceived neighborhood measures which may have influenced the results of our study.

This study has several limitations. The sample consisted largely of young and single African-American women. These results cannot be generalized to older African-American women or women from other racial groups. While the years for the environmental and participant data are fairly well matched and neighborhood disorder and crime are relatively stable over time, due to the nature of the census

and administrative data, it is still possible that objective neighborhood measures may have differed during the period of pregnancy for some women. We did not measure the length of residence in the neighborhood which may influence psychological distress or birth outcomes. Furthermore, women were enrolled from one medical center from Chicago, limiting variability of objective neighborhood conditions in our study. For our objective neighborhood measures, we selected a 0.5-mile buffer to capture women's immediate residential environment. However, we did not provide women with a definition of the "neighborhood" as a 0.5-mile around their home address. Therefore, the lack of definition for the perceived neighborhood measures may explain the low correlations between the objective and perceived neighborhood measures. We did not assess for nesting within the 0.5-mile buffer around the address given that there were no more than eight women residing in any given zip code. While only five women reported smoking during pregnancy, we did not measure secondhand smoke in our sample which may increase the risk of preterm birth. Medically, low-risk pregnant African-American women were enrolled in the study as preexisting medical diagnosis (e.g., chronic hypertension) and obstetrical complications (e.g., preeclampsia) may pose as stressors themselves and also increase the risk for preterm birth; thus, women had a lower preterm birth rate in this study compared with national data (8.9% and 16.3%, respectively). The current study had a relatively small sample size with only nine preterm births.

The results of this study suggest that psychological distress is a pathway by which neighborhood conditions may affect preterm birth. Greater efforts should be made to assess neighborhood perceptions and psychological distress in prospective longitudinal studies from preconception and spanning through the duration of pregnancy. Information gained from such studies could identify, for example, critical periods during pregnancy when neighborhood conditions that lead to psychological distress might most likely affect birth outcomes. Recent research suggest that social support mediated the effects of perceived neighborhood environment on depressive symptoms and perceived stress in samples of pregnant and postpartum African-American women (Giurgescu et al., 2015a,b). Women who perceive their neighborhood as disadvantaged may not

have the necessary social support to buffer the effects of adverse neighborhood conditions, which could result in higher levels of psychological distress (Menjivar, 2000). Nurses should encourage the partner, family and friends to offer support to the pregnant woman. Familial and partner support may contribute to women's resilience (Solivan, Wallace, Kaplan, & Harville, 2015). Offering support during pregnancy might buffer the effects of women's perceptions of neighborhood conditions on psychological distress and may have a positive effect on birth outcomes. Physical activity has also been shown to improve psychological well-being of pregnant women. Pregnant women who participated in physical activity interventions reported lower levels of depressive symptoms at the conclusion of the studies (Field, Diego, Delgado, & Medina, 2013a,b; Field et al., 2012; Robledo-Colonia, Sandoval-Restrepo, Mosquera-Valderrama, Escobar-Hurtado, & Ramírez-Vélez, 2012). Reducing stress as early as possible, and for as long as possible, during pregnancy may not only reduce the risk of preterm birth but may also prevent chronic and/or cumulative maternal stress responses from interfering with normal fetal development at critical early time points. Given the consequences of adverse neighborhood conditions on maternal mental health and pregnancy outcomes, such as our analysis suggests, public health nurses could be powerful advocates for public policies focused on improving neighborhood conditions for low-income, minority households (Acevedo-Garcia, Osypuk, McArdle, & Williams, 2008; Deguzman & Kulbok, 2012). Improving neighborhood conditions may not only reduce health disparities in preterm birth for African-American women but may also improve population health.

Pregnant African-American women are more likely to live in adverse neighborhood conditions (Larria et al., 2006; Messer et al., 2006a), to experience psychological distress (Holzman et al., 2006; Mustillo et al., 2004) and have higher rates of preterm birth (Martin et al., 2015) compared with pregnant non-Hispanic White women. We found that African-American women who reported more adverse neighborhood conditions during their second trimester of pregnancy also reported higher levels of psychological distress and had higher risk for preterm birth. Psychological distress may be the potential mechanism by which neighborhood conditions contribute to preterm birth. Prospective longitudinal studies with

larger sample sizes are needed to support the mediating effect of psychological distress on the association between neighborhood conditions and risk for preterm birth. Intervention strategies could be implemented at the individual level to reduce psychological distress and improve women's ability to cope with adverse neighborhood conditions.

## Acknowledgments

The study was funded by the National Institutes of Health, National Institute of Nursing Research R03NR010608. We thank the women who participated in the study. The authors do not have any conflict of interest.

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