



ELSEVIER

Contents lists available at ScienceDirect

SSM -Population Health

journal homepage: [www.elsevier.com/locate/ssmph](http://www.elsevier.com/locate/ssmph)

## Article

# Neighborhood disadvantage and preterm delivery in Urban African Americans: The moderating role of religious coping



Shawnita Sealy-Jefferson<sup>a,\*</sup>, Jaime Slaughter-Acey<sup>b</sup>, Cleopatra H. Caldwell<sup>c</sup>,  
Jamila Kwarteng<sup>d</sup>, Dawn P. Misra<sup>e</sup>

<sup>a</sup> Virginia Commonwealth University, Department of Family Medicine and Population Health, Division of Epidemiology, United States

<sup>b</sup> Drexel University, College of Nursing and Health Professions, United States

<sup>c</sup> University of Michigan, School of Public Health, Department of Health Behavior and Health Education, United States

<sup>d</sup> Medical College of Wisconsin, Department of Medicine, United States

<sup>e</sup> Wayne State University, School of Medicine, Department of Family Medicine and Public Health Sciences, United States

## ARTICLE INFO

## Article history:

Received 28 April 2016

Received in revised form

16 August 2016

Accepted 6 September 2016

## Keywords:

Neighborhood context

Preterm delivery

Religious coping

African American

## ABSTRACT

Evidence suggests that neighborhood disadvantage predicts preterm delivery (PTD). However, the design of most existing studies precludes within-group analyses, which would allow the identification segments of the population at highest risk, as well as preventive factors. African Americans (AA) are disproportionately affected by PTD, are disproportionately concentrated in disadvantaged neighborhoods, and frequently use religious coping in response to chronic stressors. Our objective was to examine the association between neighborhood disadvantage and PTD, and whether religious coping moderated the associations, among postpartum AA women. Addresses from participants of the Life Influences on Fetal Environments Study (n = 1387) were geocoded and linked to data from the American Community Survey. An index of neighborhood disadvantage was derived from a principal components analysis of the following variables: % below poverty, % unemployed, % receiving public assistance income, % college educated, % AA, % female-headed households, % owner occupied homes, median income, and median home value. Three domains of religious coping were assessed: organizational (church attendance), non-organizational (praying for self and asking others for prayer), and personal or subjective (experiences, perceptions, and sentiments about religion), and all were dichotomized as frequent/infrequent or satisfied/not satisfied. Preterm delivery was defined as birth before 37 completed weeks of gestation. Prevalence ratios and 95% confidence intervals were estimated with log binomial regression models. Neighborhood disadvantage did not predict PTD rates in the overall sample. However, there was evidence of moderation by asking others for prayer ( $P$  for asking for prayer X disadvantage index interaction term: 0.01). Among women who infrequently asked others for prayer, neighborhood disadvantage was positively associated with PTD rates (adjusted Prevalence ratio: 1.28, 95% Confidence Interval: 1.01, 1.63), and a null association was found for those who frequently asked others for prayer. No evidence of moderation by the other religious coping variables was present. Non-organizational religious coping may buffer against the adverse effects of neighborhood disadvantage on PTD rates, among urban AA women. Future research should examine the mechanisms of the reported relationships.

© 2016 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

Racial disparities in preterm delivery (PTD), or birth prior to 37 completed weeks of gestation, have existed for decades, with African American (AA) women being disproportionately impacted (Branum & Schoendorf, 2002; Costa, 2004). While the leading cause of infant

mortality in the United States is PTD, the etiology of PTD remains unknown (Romero, Dey, & Fisher, 2014). Social conditions have been posited as fundamental causes of health inequalities (Phelan, Link, & Tehranifar, 2010). For instance, the quality of the residential environment (or neighborhood) is patterned by racial/ethnic status and social position, (Diez Roux & Mair, 2010) such that AAs compared to Non-Hispanic whites (NHW), are more likely to reside in disadvantaged neighborhoods, including those with inadequate municipal services and health care resources, increased crime, violence, and poor housing quality (Culhane & Elo, 2005).

\* Correspondence to: Virginia Commonwealth University, P.O. Box 980212, Richmond, VA 23298, United States.

E-mail address: [ssealyjeffers@vcu.edu](mailto:ssealyjeffers@vcu.edu) (S. Sealy-Jefferson).

Much of the literature on the relationship between neighborhood context and PTD uses vital statistics data (Miranda, Messer & Kroeger, 2012; Farley 2006; Masho, Munn & Archer, 2014; O'Campo, Burke & Culhane, 2008; Janevic et al., 2010; Vinikoor-Imler, Messer, Evenson & Laraia, 2011; Ma, Liu, Hardin, Zhao & Liese, 2015; Masi, Hawkey, Piotrowski & Pickett, 2007; Wallace et al., 2013; Messer, Kaufman, Dole, Savitz & Laraia, 2006; Ncube, Enquobahrie, Albert, Herrick & Burke, 2016). Results from a recent meta-analysis, which included three studies focused on AAs, all of which used vital statistics data, suggested modest positive associations, with a stronger relationship among Whites compared to AAs (Ncube et al., 2016). However, limitations of using vital statistics data include inaccurate reporting of clinical information including gestational age, and that the data is collected for public health surveillance, rather than to answer specific clinical or population-based research questions (Schoendorf & Branum, 2006).

Studies which use primary collected data can include a more complete assessment and control for social determinants which may confound or modify the association between neighborhood context and PTD. In the most recently published study using primary collected data, Bastek and colleagues reported no significant association between neighborhood context and PTD in a cohort of 817 mostly AA women from Philadelphia (Bastek et al., 2015). Similarly, Phillips et al. examined the association between an aggregate socioeconomic measure of neighborhood quality and spontaneous PTD, using data from the Black Women's Health Study and found no significant associations (Phillips, Wise, Rich-Edwards, Stampfer, and Rosenberg, 2013).

Social exposures have complex and dynamic relationships and interactions, (Hertzman & Boyce, 2010) but only a few studies examined whether the impact of neighborhood exposures on PTD varies by social factors. Phillips et al., found no evidence that the association between neighborhood quality and spontaneous PTD varied by sociodemographic or geographic variables. On the other hand, Ahern et al., using data from a case-control study of AA and Whites, reported that among AAs, the association between neighborhood characteristics and PTD was modified by individual-level socioeconomic status (Ahern, Pickett, Selvin, & Abrams, 2003). Further, our group recently published results from a study where we found evidence of effect modification of the association between subjective reports of the residential environment and PTD, by educational attainment, among AA women (Sealy-Jefferson, Giurgescu, Helmkamp, Misra, & Osypuk, 2015).

Religiosity has been conceptualized as a social determinant of health, (Idler, 2014) and includes several domains, including organizational (formal church attendance), non-organizational (private of informal activities), and personal or subjective (experiences, perceptions, and sentiments about religion) (Pargament, 1997; Chatters, Levin & Taylor, 1992; Taylor, Mattis & Chatters, 1999). Specifically, non-organizational religiosity, including prayer, reading religious materials, and soliciting support and prayers from a religious community, is a common response to health issues, chronic poverty, racism, and adverse residential environment among AAs (Dunn and Horgas, 2000; Krause, 1998). Religious coping is also more prevalent among women, (Ellison and Taylor, 1996) and praying for oneself or asking someone to 'pray on your behalf' is among the most utilized forms of coping with individual problems and stress, among AAs (Taylor, Chatters, & Levin, 2004). Since neighborhood disadvantage is conceptualized as a stressor, and stress during pregnancy has been established as a risk factor for adverse birth outcomes, (Dunkel Schetter, 2011) examining the associations between neighborhood stressors, religious coping, and PTD among urban AA women could help to identify subgroups of the population which are most susceptible to the influences of adverse neighborhood conditions.

As a result, our objective was to examine the associations between a composite measure of neighborhood quality and PTD,

among urban AA women, and to determine whether the associations were modified by different approaches to religious coping. We tested the following hypotheses: (1) The association between neighborhood disadvantage (composite measure) and PTD is moderated by religious coping among urban AA women, and (2) the neighborhood disadvantage -PTD association is attenuated in those who utilize religious coping more frequently. Further, in exploratory analyses, we examined the same hypotheses as above, but for each neighborhood variable which comprised the composite disadvantage index, separately.

## 2. Methods

### 2.1. Study design

Details of the study design have been previously published (Sealy-Jefferson et al., 2015). In brief, the Life Influences on Fetal Environments (LIFE) study is a retrospective cohort, with enrollment occurring from 2009 to 2011 (but the current analysis uses cross-sectional data). The primary objective of the study was to determine how racism is associated with PTD (Slaughter-Acey, Sealy-Jefferson, & Helmkamp, 2016). Self-identified African American women ( $\geq 18$  years old) who delivered a singleton infant, were recruited at a hospital in Oakland County, Michigan. Women were excluded from the study if they: (1) did not speak English or (2) had intellectual disabilities, serious cognitive deficits, or significant mental illness, on the basis of history or any prior records. In-person interviews were conducted during women's postpartum hospital stay and medical history was abstracted from medical records. The final study sample included 1411 women which represented 71% of the women approached for study participation. This study was approved by institutional review boards at St. John Providence Health System, University of Michigan and Wayne State University. All study participants gave written informed consent.

### 2.2. Outcome ascertainment

PTD was defined as delivery prior to 37 completed weeks of gestation. Gestational age was determined using data obtained from the medical record. We employed a hierarchical algorithm, with priority given to the provider's estimate of gestational age based on early ultrasound (between 6–20 weeks gestation) as this is considered the most valid measure of gestational age (Kalish, Thaler & Chasen, 2004; Verburg, Steegers & De Ridder, 2008). Early ultrasound estimates of gestational age ( $n=692$ ) were compared to other estimates including date of last menstrual period. In the case of an inconsistency, the estimate based on the early ultrasound was used, unless it was implausible ( $< 22$  weeks or  $> 44$  weeks gestation) (Talge, Mudd, Sikorskii, & Basso, 2014). When a gestational age estimate based on an early ultrasound was not available, the last menstrual period was used ( $n=465$ ). In rare cases where both the early ultrasound and last menstrual period estimates of gestational age were missing or implausible, we used the late ultrasound estimate (after 20 weeks gestation) ( $n=169$ ) or the provider's estimate of gestation at birth ( $n=62$ ), or that from the medical record at birth, if all else was missing ( $n=22$ ).

### 2.3. Exposure ascertainment

Current addresses were self-reported ( $n=1181$ ), and if incomplete or missing ( $n=230$ ), were ascertained from the medical record, and were geocoded. Twenty four addresses could not be matched, and were omitted from the analysis; the final analytic sample included 1387 women. The latitude and longitude of each

matched address was spatially linked to 5-year block group estimates (2007–2011) from the American Community survey (ACS), using ArcGIS 10.2. The following 9 variables from the ACS were used to characterize the quality of the residential environment: % below poverty, % unemployed, % receiving public assistance income, % African American, % female-headed households, % college graduate, % owner-occupied homes, median income, and median home value. Principal components analysis was used to generate a summary score representing objective neighborhood disadvantage, which was a linear composite of the nine optimally weighted ACS variables (higher score = more disadvantage) (Messer, Laraia & Kaufman, 2006; Messer & Kaufman, 2006). Factor loadings were highest for median income (84%), and lowest for % of owner occupied homes (42%) (data not shown).

#### 2.4. Effect modifiers

Given that religiosity is a multidimensional construct, we tested whether various measures of religious coping modified the association between neighborhood disadvantage and PTD. Current religious coping was self-reported and categorized into organizational, non-organizational, and subjective domains (Jackson, Torres & Caldwell, 2004; Jackson, Neighbors, Nesse, Trierweiler & Torres, 2004). Religious service attendance (organizational domain) was ascertained with “How often do you attend religious services?”, answer choices were: everyday, at least once a week, a few times a month, a few times a year, less than once a year, and never. Non-organizational religious coping was assessed with two questions: (1) “How often do you pray”, and (2) “How often do you ask someone to pray for you”, with responses on a Likert scale (very often, fairly often, not too often, or never). For the subjective religiosity domain, participants were asked, “How satisfied are you with the quality of the relationships you have with the people in your church or place of worship”, and answer choices ranged from 1 (completely satisfied) to 7 (completely dissatisfied).

#### 2.5. Statistical analysis

Cut-points for all covariates in our analysis were based on the distributions in the sample. Univariate and bivariate statistics were used to describe the data, with Wilcoxon rank sum and chi-square tests used to assess group differences for continuous and categorical variables, respectively. Pearson correlations were estimated for individual ACS neighborhood and religious coping variables. In order to interpret the results as the quality of the residential environment among women in the 75th versus the 25th percentile of the distribution of each neighborhood variable, we re-scaled the continuous neighborhood variables by their interquartile range. We considered using hierarchical models to estimate the multi-level association between neighborhood disadvantage and PTD, however there was insufficient variability in PTD rates, by block group in the sample (intra-class correlation coefficient: 0.96%). As a result, we estimated prevalence ratios (PRs) and their associated 95% confidence intervals, using log binomial regression models, to examine the relationship between PTD and each individual ACS neighborhood variable (separately) and with the neighborhood disadvantage index. Models were run unadjusted and adjusted for the following self-reported, individual-level variables, which were identified from the literature as possible confounders: age (< 35, ≥ 35 years), income (median split: < \$35,000, ≥ \$35,000/year), maternal relationship status (dichotomized as married or cohabitating with the father of the baby, versus not married or cohabitating with the father of the baby), and educational attainment (≤ 12, > 12 years). Our education variable included the highest level of education and considered several sources, including number of completed years, year of high school graduation,

alternative education (e.g. general equivalency, career academies, and technical training), as well as traditional brick and mortar and online college attendance, and college graduation. We categorized the education variable as ≤ 12 and > 12 years based on the heterogeneity in type of education among those who reported > 12 years. Moderation by the 3 domains of religious coping was assessed with interaction terms between individual indicators and a composite measure of neighborhood disadvantage (each modeled separately) and each religious coping variable. Non-organizational religious coping variables were categorized as frequently (very often) and infrequently (including fairly often, not too often, and never). Organizational religious coping was dichotomized at the median as frequently and infrequently. Subjective religiosity was also dichotomized at the median and categorized as satisfied versus not satisfied. We present models stratified by religious coping, if warranted. All variables were assessed for missing data, and list-wise deletion was employed. The proportion of missingness ranged from 0% to 11% (n = 152 missing for income). Due to the exploratory and hypothesis generating nature of this work, we did not adjust for multiple comparisons. Two-sided  $p < 0.05$  (for interaction terms), and confidence intervals which did not overlap 1 (for log binomial models) were considered significant. Analyses were conducted with SAS, version 9.4 for Windows (SAS Institute, Inc., Cary, North Carolina).

### 3. Results

Table 1 displays demographic and religious coping characteristics of the study population. The mean age of the sample was 27 years, over 50% were married to or cohabitating with the father of the baby, and more than 70% had a more than 12 years of education. More than half of the women resided in their current neighborhood for ≤ 2 years. Roughly 50% of study participants reported frequent religious service attendance and a similar number reported satisfaction with the quality of the relationships they had with people from their church or place of worship. Approximately 37% asked others to pray for them frequently, while 68% reported praying for themselves frequently. There were weak correlations between the religious coping variables with the highest between religious service attendance and satisfaction with the quality of the relationships with people in church or place of worship (0.41). Similarly, for individual neighborhood quality indicators, weak to moderate correlations were observed, with the highest between median income and median home values (0.68) (data not shown).

Table 2 shows the mean and standard deviation of the composite neighborhood disadvantage index and the individual ACS variables, as well as results of log binomial regression analysis of PTD rates among women in the 75th versus the 25th percentiles of individual indicators of neighborhood quality, and our disadvantage index. There was evidence of moderation of the association between neighborhood disadvantage (composite and some individual measures) and PTD by both praying for oneself and asking others for prayer (Table 2). Specifically, asking others for prayer modified associations between PTD rates and the following neighborhood quality measures (p for interaction terms): % African American (p = 0.02), % below poverty (p = 0.02), % female-headed households (p = 0.003), median income (p = 0.002), % college graduate (p = 0.004), median home value (p < 0.001), and the index of neighborhood disadvantage (p = 0.005). Evidence of moderation by praying for oneself was present for associations between PTD and % unemployed (p = 0.02), % below poverty (p = 0.02), median income (p = 0.04), and median home value (p = 0.02).

Given the evidence of interactions between non-organizational religious coping (asking others for prayer, and praying for self)

**Table 1**  
Demographic characteristics of study participants and results of bivariate log-binomial models; Life Influences on Fetal Environments Study (n = 1387) 2009–2011.

	Missing N (%)	Term Delivery (n=1160) N (%)	Preterm (n=226) N (%)	PR	95% CI
Age	0 (0)				
18-19		102 (8.79)	14 (6.19)	0.83	0.48, 1.45
20-24		354 (30.52)	73 (32.30)	1.18	0.85, 1.63
25-29		313 (26.98)	53 (23.45)	<i>Referent</i>	
30-34		223 (19.22)	43 (19.03)	1.12	0.77, 1.62
35+		168 (14.48)	43 (19.03)	1.41	1.00, 2.03
Relationship status	11 (0.79)				
Not married or cohabitating with FOB		543(47.18)	102(45.54)	0.94	0.74, 1.20
Married to or cohabitating with FOB		608 (52.41)	122 (53.98)	<i>Referent</i>	
Education (years)	5 (0.36)				
≤ 12		333 (28.71)	62 (27.43)	<i>Referent</i>	
> 12		827 (71.29)	164 (72.57)	1.05	0.81, 1.38
Income	152 (10.96)				
Under \$35,000		530 (45.69)	123(54.42)	1.29	1.00, 1.66
\$35,000 or more		497 (42.84)	85 (37.61)	<i>Referent</i>	
Time in current neighborhood	22 (1.59)				
≤ 24 months		641 (55.26)	123 (54.42)	<i>Referent</i>	
> 24 months		501 (43.19)	99 (43.81)	1.03	0.80, 1.31
Religious service attendance	13 (0.94)				
Frequently		639 (55.09)	121 (53.54)	<i>Referent</i>	
Infrequently		511 (44.05)	102 (45.13)	1.05	0.82, 1.33
*Satisfaction with quality of relationships with people from religious services	197 (14.20)				
Satisfied		573 (49.40)	119 (52.65)	<i>Referent</i>	
Not satisfied		423 (36.47)	74 (32.74)	0.87	0.66, 1.13
Ask others to pray for you	116 (8.36)				
Frequently		376 (35.44)	90 (43.06)	<i>Referent</i>	
Infrequently		685 (64.56)	119 (56.94)	1.30	1.02, 1.67
Pray for yourself	93 (0.94)				
Frequently		730 (67.66)	151 (70.56)	<i>Referent</i>	
Infrequently or never		349 (32.34)	63 (29.44)	1.12	0.86, 1.47

PR: bivariate prevalence ratio; 95% CI: confidence interval; n: number; FOB: father of the baby; not married includes divorced, separated, widowed, in a relationship with the FOB and non-FOB partner; married includes women who reported being married to or cohabitating with the father of the baby; \*only people who reported attending religious services answered this question

**Table 2**  
Log-binomial regression results for associations comparing the 75th versus the 25th percentiles of individual neighborhood quality indicators and an index of neighborhood disadvantage and preterm delivery, and interaction effects between religious coping and neighborhood characteristics; Life Influences on Fetal Environments Study (n = 1387), 2009–2011.

Neighborhood Characteristic	Mean (SD)	Unadjusted		Adjusted*		Asking others for prayer X neighborhood characteristic P value	Praying for self X neighborhood characteristic P value	Church attendance X neighborhood characteristic P value	Satisfaction with re- lationships with people from church X neighborhood characteristic P value
		PR	95%CI	PR	95% CI				
<b>Disadvantage Index</b>	0 (1)	1.08	0.92, 1.28	1.03	0.86, 1.23	0.005	0.12	0.94	0.96
<b>Individual Variables</b>									
% welfare	5.96 (6.74)	1.05	0.93, 1.18	1.04	0.92, 1.19	0.80	0.67	0.99	0.92
%unemployed	11.04 (7.16)	1.02	0.89, 1.17	1.00	0.87, 1.15	0.10	0.02	0.78	0.94
% African American	69.91 (32.18)	1.01	0.84, 1.21	0.97	0.80, 1.18	0.02	0.62	0.72	0.90
% below poverty	12.25 (11.20)	1.09	0.95, 1.24	1.08	0.94, 1.25	0.02	0.02	0.82	0.08
% female headed household	25.21 (13.43)	1.20	1.03, 1.39	1.15	0.98, 1.36	0.003	0.38	0.32	0.44
% owner occupied homes	58.56 (27.58)	0.99	0.83, 1.18	1.00	0.83, 1.20	0.56	0.97	0.45	0.91
median income	\$43,068.13 (\$22,197.00)	0.98	0.81, 1.08	0.98	0.84, 1.14	0.002	0.04	0.78	0.74
% college graduate	29.66 (16.75)	1.01	0.85, 1.09	1.09	0.91, 1.31	0.004	0.11	0.95	0.66
Median home value	\$102,933.60 (\$63,117.32)	0.99	0.88, 1.11	1.03	0.92, 1.15	< 0.001	0.02	0.70	0.78

SD: standard deviation

\* models adjusted for age, relationship status and income; PR: prevalence ratio; 95% CI: confidence interval; p: p-value

with both individual and composite neighborhood quality indicators, we present the stratified parameter estimates (Tables 3 and 4, respectively). Among women who asked for prayer *infrequently*, those who lived in neighborhoods with high disadvantage (composite measure) had higher PTD rates than

women who lived in neighborhoods with low disadvantage (adjusted PR (aPR)): 1.28, 95% CI: 1.01, 1.62) (Table 3). When we examined associations between PTD and individual neighborhood quality measures separately, stratified by asking others for prayer, a complex set of results emerged. Among women who asked for

**Table 3**  
Log binomial models, stratified by asking others for prayer, for associations between individual neighborhood quality indicators and an index of neighborhood disadvantage, and preterm delivery among African American women; Life Influences on Fetal Environments Study (n = 1271), 2009–2011.

Neighborhood variables	Frequently (n=466)				Infrequently (n=805)			
	Unadjusted		Adjusted*		Unadjusted		Adjusted*	
	PR 95% CI		PR 95% CI		PR 95% CI		PR 95% CI	
Disadvantage index	0.86	0.67, 1.12	0.79	0.60, 1.05	1.31	1.04, 1.64	1.28	1.01, 1.62
Individual ACS variables								
% African American	0.84	0.65, 1.10	0.77	0.59, 1.01	1.15	0.88, 1.49	1.18	0.88, 1.57
% below poverty	0.90	0.71, 1.14	0.88	0.68, 1.13	1.21	1.03, 1.43	1.24	1.05, 1.46
% female headed households	0.95	0.74, 1.29	0.88	0.67, 1.15	1.46	1.19, 1.78	1.46	1.18, 1.80
Median income	1.21	1.00, 1.45	1.23	1.01, 1.50	0.74	0.59, 0.93	0.77	0.61, 0.98
% college graduate	1.33	1.04, 1.70	1.37	1.06, 1.77	0.80	0.63, 1.02	0.86	0.66, 1.12
Median home value	1.29	1.13, 1.47	1.35	1.17, 1.56	0.76	0.63, 0.92	0.77	0.63, 0.94

\* models adjusted for age, relationship status, educational attainment, and income; ACS: American community survey; PR: prevalence ratio; 95% CI: confidence interval; p: p-value

**Table 4**  
Results of log binomial models, stratified by praying for self, for associations between individual neighborhood quality indicators and preterm delivery among African American women; Life Influences on Fetal Environments Study (n = 1294), 2009–2011.

Neighborhood variables	Frequently (n=881)				Infrequently (n=413)			
	Unadjusted		Adjusted*		Unadjusted		Adjusted*	
	PR 95% CI		PR 95% CI		PR 95% CI		PR 95% CI	
% Unemployed	0.97	0.82, 1.14	0.94	0.79, 1.12	1.29	1.02, 1.63	1.31	1.03, 1.68
% below poverty	0.99	0.83, 1.18	0.98	0.82, 1.18	1.30	1.06, 1.60	1.34	1.10, 1.64
Median home value	1.05	0.95, 1.16	1.08	0.98, 1.19	0.74	0.58, 0.96	0.77	0.58, 1.01
Median income	1.02	0.87, 1.19	1.05	0.88, 1.25	0.68	0.48, 0.94	0.72	0.50, 1.03

\* models adjusted for age, relationship status, educational attainment, and income; PR: prevalence ratio; 95% CI: confidence interval; p: p-value

prayer frequently, PTD rates were higher among those who lived in neighborhoods with high median income (aPR: 1.23, 95% CI: 1.01, 1.50), % college graduates (aPR: 1.37, 95% CI: 1.06, 1.77) and median home values (aPR: 1.35, 95% CI: 1.17, 1.56), compared to women who lived in neighborhoods with low median income, % college graduates and median home values. In women who asked for prayer infrequently, we observed significant adjusted associations between PTD and % below poverty, % female headed households, median income, and median home values that were in the expected direction.

The PTD rates among those women who reported praying for themselves infrequently appeared to be affected by features of neighborhood environment (Table 4). Specifically, PTD rates among women who reported praying for themselves infrequently, were positively associated with neighborhood % unemployed (aPR: 1.31, 95% CI: 1.03, 1.68) and % below poverty (aPR: 1.34, 95% CI: 1.10, 1.64).

#### 4. Discussion

Our study is the first to examine the moderating role of religious coping on the impact of neighborhood disadvantage on PTD rates, among African American women. Our primary finding was that non-organizational forms of religious coping may interact with neighborhood disadvantage to impact PTD rates, among urban AA women. Specifically, we found evidence to support our hypothesis that religious coping may buffer AA women against the influences on PTD of living in a neighborhood with high disadvantage. We also found evidence suggesting that among women who reported frequently asking others to pray for them, several positive neighborhood characteristics were surprisingly associated with increased PTD rates.

Religious social support has been associated with several health benefits, and may provide recipients with increased self-confidence, knowledge, camaraderie, and valuable assistance, which buffers against the effects of stress (Cohen & Stress, 1985). It is unclear why we observed positive associations between neighborhood % college graduate, median income, and home values and PTD, only among women who ask for prayer frequently. It is possible that in these neighborhoods, other social factors (including police brutality, violent and property crime, etc.) were present, which could increase PTD rates by increasing levels of maternal stress, even despite increased neighborhood socioeconomic status and educational level of residents. Increased levels of maternal stress can lead to rising levels of the corticotropin-releasing hormone that triggers a sequence of events that result in PTD (Wadhwa, 2001). Further, the stressful impact of these exposures may overwhelm the potential 'protective' effects of these positive neighborhood features on PTD rates, and could conceivably cause residents to solicit more frequent prayers from others on their behalf. More research on this specific phenomenon is warranted, especially given the evidence that gains from educational achievement are not equally manifested in AAs and Whites. In particular, systematic social observations and/or linking crime data to resident perception and demographic data could increase our understanding of these processes.

Our study has several strengths. First, we are the first to examine and identify interactive associations between neighborhood quality and non-organizational religious coping and how they may act together to impact PTD rates, among urban AA women. This work adds to the literature on neighborhood effects, in that we examine within-group variations of the impact of neighborhood disadvantage on PTD among a high risk group. Our study population is understudied, and is at high risk for PTD, and we identify

a novel preventive factor in this group. In this study, we present results from a composite measure as well as individual indicators of neighborhood disadvantage, which will be useful for future hypothesis generation, as to which specific features of the residential environment may increase risk of PTD, as well as testing potential mechanisms.

In interpreting the results from our study, the following limitations should be considered. There is a potential for measurement error and residual confounding, especially given our ascertainment of neighborhood characteristics from the ACS, data which may be unequal proxies of adverse neighborhood quality. Next, 11% of our sample had missing data on individual income, and as a result, bias in our parameter estimates cannot be ruled out. This study was cross-sectional in nature, and as such, we cannot make causal inferences, or rule out the possibility that women who had a PTD may have differentially reported their religious coping habits, compared to women who had a term delivery. Since theories suggest that religious socialization occurs across the life-course, (Wielhouwer, 2004) future longitudinal studies should examine whether change in religiosity over time moderates the associations presented here. Our study sample was recruited from one hospital in Metropolitan Detroit, Michigan. However, this site was chosen based on several reasons, including its wide catchment area, the heterogeneity of women receiving medical care (64 municipalities from 3 counties), and the large number of births per year.

In summary, neighborhood quality, as assessed by administratively defined individual and composite indicators, may not impact PTD rates equally among all women, and may be moderated by non-organizational religiosity. Future studies should examine the ways in which religious coping may be a relevant form of social support for women across the life-course, and how this support may buffer women from exposures to the complex social determinants of adverse birth outcomes.

## References

- Ahern, J., Pickett, K. E., Selvin, S., & Abrams, B. (2003). Preterm birth among African American and white women: a multilevel analysis of socioeconomic characteristics and cigarette smoking. *Journal of Epidemiology and Community Health, 57*(8), 606–611.
- Bastek, J. A., Sammel, M. D., Jackson, T. D., Ryan, M. E., McShea, M. A., & Elovitz, M. A. (2015). Environmental variables as potential modifiable risk factors of preterm birth in Philadelphia, PA. *American Journal of Obstetrics and Gynecology, 212*(2).
- Branum, A. M., & Schoendorf, K. C. (2002). Changing patterns of low birthweight and preterm birth in the United States, 1981–98. *Paediatric and Perinatal Epidemiology, 16*(1), 8–15.
- Chatters, L. M., Levin, J. S., & Taylor, R. J. (1992). Antecedents and dimensions of religious involvement among older black adults. *Journals of Gerontology, 47*(6), S269–S278.
- Cohen, S., & Wills, T. A. (1985). Stress social support, and the buffering hypothesis. *Psychological Bulletin, 98*(2), 310–357.
- Costa, D. L. (2004). Race and pregnancy outcomes in the twentieth century: a long-term comparison. *The Journal of Economic History, 64*(4), 1056–1086.
- Culhane, J. F., & Elo, I. T. (2005). Neighborhood context and reproductive health. *American Journal of Obstetrics and Gynecology, 192*(5 Suppl), S22–S29.
- Diez Roux, A. V., & Mair, C. (2010). Neighborhoods and health. *Annals of the New York Academy of Sciences, 1186*, 125–145.
- Dunkel Schetter, C. (2011). Psychological science on pregnancy: stress processes, biopsychosocial models, and emerging research issues. *Annual Review of Psychology, 62*(1), 531–558.
- Dunn, K. S., & Horgas, A. L. (2000). The prevalence of prayer as a spiritual self-care modality in elders. *Journal of Holistic Nursing, 18*(4), 337–351.
- Ellison, C. G., & Taylor, R. J. (1996). Turning to prayer: social and situational antecedents of religious coping among African Americans. *Review of Religious Research, 38*(2), 111–131.
- Farley, T. A. (2006). The relationship between the neighbourhood environment and adverse birth outcomes. *Paediatric and Perinatal Epidemiology, 20*(3), 188–200.
- Hertzman, C., & Boyce, T. (2010). How experience gets under the skin to create gradients in developmental health. *Annual Review of Public Health, 31*, 329–347. 323p following 347.
- Idler, E. L. (2014). *Religion as a social determinant of public health*. USA: Oxford University Press.
- Jackson, J. S., Torres, M., Caldwell, C. H., et al. (2004). The national survey of American life: a study of racial, ethnic and cultural influences on mental disorders and mental health. *International Journal of Methods in Psychiatric Research, 13*(4), 196–207.
- Jackson, J. S., Neighbors, H. W., Nesse, R. M., Trierweiler, S. J., & Torres, M. (2004). Methodological innovations in the National Survey of American Life. *International Journal of Methods in Psychiatric Research, 13*(4), 289–298.
- Janevic, T., Stein, C. R., Savitz, D. A., Kaufman, J. S., Mason, S. M., & Herring, A. H. (2010). Neighborhood deprivation and adverse birth outcomes among diverse ethnic groups. *Annals of Epidemiology, 20*(6), 445–451.
- Kalish, R. B., Thaler, H. T., Chasen, S. T., et al. (2004). First- and second-trimester ultrasound assessment of gestational age. *American Journal of Obstetrics and Gynecology, 191*(3), 975–978.
- Krause, N. (1998). Neighborhood deterioration, religious coping, and changes in health during late life. *Gerontologist, 38*(6), 653–664.
- Ma, X., Liu, J., Hardin, J. W., Zhao, G., & Liese, A. D. (2015). Neighborhood food access and birth outcomes in South Carolina. *Maternal and Child Health Journal*.
- Masho, S. W., Munn, M. S., & Archer, P. W. (2014). Multilevel factors influencing preterm birth in an urban setting. *Urban Planning and Transport Research, 2*(1), 36–48.
- Masi, C. M., Hawkey, L. C., Piotrowski, Z. H., & Pickett, K. E. (2007). Neighborhood economic disadvantage, violent crime, group density, and pregnancy outcomes in a diverse, urban population. *Social Science and Medicine, 65*(12), 2440–2457.
- Messer, L. C., & Kaufman, J. S. (2006). *Using census data to approximate neighborhood effects*. San Francisco, CA: Jossey Bass.
- Messer, L. C., Laraia, B. A., Kaufman, J. S., et al. (2006). The development of a standardized neighborhood deprivation index. *Journal of Urban Health, 83*(6), 1041–1062.
- Messer, L. C., Kaufman, J. S., Dole, N., Savitz, D. A., & Laraia, B. A. (2006). Neighborhood crime, deprivation, and preterm birth. *Annals of Epidemiology, 16*(6), 455–462.
- Miranda, M. L., Messer, L. C., & Kroeger, G. L. (2012). Associations between the quality of the residential built environment and pregnancy outcomes among women in North Carolina. *Environmental Health Perspectives, 120*(3), 471–477.
- Ncube, C. N., Enquobahrie, D. A., Albert, S. M., Herrick, A. L., & Burke, J. G. (2016). Association of neighborhood context with offspring risk of preterm birth and low birthweight: a systematic review and meta-analysis of population-based studies. *Social Science & Medicine, 153*, 156–164.
- O'Campo, P., Burke, J. G., Culhane, J., et al. (2008). Neighborhood deprivation and preterm birth among non-Hispanic Black and White women in eight geographic areas in the United States. *American Journal of Epidemiology, 167*(2), 155–163.
- Pargament, K. (1997). *The psychology of religion and coping: theory, research, practice*. New York: Guilford.
- Phelan, J. C., Link, B. G., & Tehranifar, P. (2010). Social conditions as fundamental causes of health inequalities: theory, evidence, and policy implications. *Journal of Health and Social Behavior, 51*(1 suppl), S28–S40.
- Phillips, G. S., Wise, L. A., Rich-Edwards, J. W., Stampfer, M. J., & Rosenberg, L. (2013). Neighborhood socioeconomic status in relation to preterm birth in a U.S. cohort of black women. *Journal of Urban Health: Bulletin of the New York Academy of Medicine, 90*(2), 197–211.
- Romero, R., Dey, S. K., & Fisher, S. J. (2014). Preterm labor: one syndrome, many causes. *Science, 345*(6198), 760–765.
- Schoendorf, K. C., & Branum, A. M. (2006). The use of United States vital statistics in perinatal and obstetric research. *American Journal of Obstetrics and Gynecology, 194*(4), 911–915.
- Sealy-Jefferson, S., Giurgescu, C., Helmkamp, L., Misra, D. P., & Osypuk, T. L. (2015). Perceived physical and social residential environment and preterm delivery in African-American Women. *American Journal of Epidemiology, 182*(6), 485–493.
- Slaughter-Acey, J. C., Sealy-Jefferson, S., Helmkamp, L., et al. (2016). Racism in the form of micro aggressions and the risk of preterm birth among black women. *Annals of Epidemiology, 26*(1).
- Talge, N. M., Mudd, L. M., Sikorskii, A., & Basso, O. (2014). United States birth weight reference corrected for implausible gestational age estimates. *Pediatrics, 133*(5), 844–853.
- Taylor, R., Chatters, L., & Levin, J. (2004). *Religion in the lives of African Americans: social, psychological and health perspectives*. Thousand Oaks: Sage Press.
- Taylor, R. J., Mattis, J., & Chatters, L. M. (1999). Subjective religiosity among African Americans: a synthesis of findings from five national samples. *Journal of Black Psychology, 25*(4), 524–543.
- Verburg, B. O., Steegers, E. A., De Ridder, M., et al. (2008). New charts for ultrasound dating of pregnancy and assessment of fetal growth: longitudinal data from a population-based cohort study. *Ultrasound in Obstetrics and Gynecology, 31*(4), 388–396.
- Vinikoor-Imler, L. C., Messer, L. C., Evenson, K. R., & Laraia, B. A. (2011). Neighborhood conditions are associated with maternal health behaviors and pregnancy outcomes. *Social Science & Medicine, 73*(9), 1302–1311.
- Wadhwa, P. D. (2001). Stress and preterm birth: neuroendocrine, immune/inflammatory, and vascular mechanisms. *Maternal and Child Health Journal, 5*(2), 119–125.
- Wallace, M., Harville, E., Theall, K., Webber, L., Chen, W., & Berenson, G. (2013). Neighborhood poverty, allostatic load, and birth outcomes in African American and white women: findings from the Bogalusa Heart Study. *Health Place, 24*, 260–266.
- Wielhouwer, P. W. (2004). The impact of church activities and socialization on African-American religious commitment\*. *Social Science Quarterly, 85*(3), 767–792.