Title

Interactions between race/ethnicity, poverty status, and pregnancy cardio-metabolic diseases in prediction of postpartum cardio-metabolic health

Permalink

https://escholarship.org/uc/item/8tw4937b

Journal

Ethnicity and Health, 25(8)

ISSN

1355-7858

Authors

Ross, Kharah M
Guardino, Christine
Schetter, Christine Dunkel
et al.

Publication Date

2020-11-16

DOI

10.1080/13557858.2018.1493433

Peer reviewed

Interactions between race/ethnicity, poverty status, and pregnancy cardio-metabolic disorders and maternal postpartum cardio-metabolic risk

Kharah M. Ross, PhD[a*], **Christine Guardino, PhD**[b], **Christine Dunkel Schetter, PhD**[c], and **Calvin J. Hobel, MD**[d]

[a*]Department of Psychology, University of California: Los Angeles, 1285 Franz Hall, 502 Portola Plaza, Los Angeles, 90095, US; 310-825-2961, kross@psych.ucla.edu

[b]Department of Psychology, Dickinson College, 28 North College St, Carlisle, 17013, US; 717-245-1255; guardinc@dickinson.edu

[c]Department of Psychology, University of California: Los Angeles, 1285 Franz Hall, 502 Portola Plaza, Los Angeles, 90095, US; 310-825-2961, dunkel@psych.ucla.edu

[d]Department of Obstetrics and Gynecology, Cedars Sinai Medical Center, 8631 W Third St Suite 1001, Los Angeles, 90048, US; 310-423-3365; calvin.hobel@cshs.org

Abstract

Background: Prenatal health disparities exist for African Americans and low socioeconomic status (SES) individuals when compared to non-Hispanic Whites and people of higher SES, particularly in cardio-metabolic diseases. Furthermore, having had a pregnancy-specific cardio-metabolic disease, e.g. preeclampsia, increases risk for future cardio-metabolic disease. Although these factors (race, SES and pregnancy cardio-metabolic disease) are interrelated, studies have rarely considered their combined effect on postpartum cardio-metabolic risk. The purpose of this study was to assess whether SES, race/ethnicity, and prenatal cardio-metabolic disease interact in the prediction of postpartum cardio-metabolic risk.

Methods.—A sample of 1717 low-income women of African American, Latina, non-Hispanic White race/ethnicity was recruited after a birth in 5 US sites. Household income was used to categorize poverty status as Poor (< Federal Poverty Level; FPL), near poor (100-200% FPL), or low/middle income (>200% FPL). Three prenatal cardio-metabolic disease diagnoses (preeclampsia, gestational hypertension, gestational diabetes) were identified from medical records. Four biomarkers (mean arterial pressure, glycosylated haemoglobin, total cholesterol:HDL ratio, and waist-hip ratio) were collected at 6 and 12 months postpartum, and combined into an average postpartum cardio-metabolic risk index. Maternal age, pre-pregnancy body mass index, parity, health behaviours and employment status were covariates.

Results: Analyses revealed interactions of race/ethnicity, poverty status, and prenatal cardio-metabolic diseases in the prediction of postpartum cardio-metabolic risk. African American

women had higher postpartum cardio-metabolic risk, which was exacerbated following a prenatal cardio-metabolic disease. Low/middle income African American women had higher cardio-metabolic risk compared to poor African American, and all Latina and White women.

Conclusions.—African American women, and especially those who experienced pregnancy complications, emerged as vulnerable, and greater household income did not appear to confer protection against worse postpartum cardio-metabolic risk for this group. These results highlight the complex interplay between socioeconomic status and race/ethnicity with respect to understanding health disparities.

Keywords

Pregnancy; postpartum; race/ethnicity; poverty; cardio-metabolic risk; gestational hypertension; gestational diabetes; pre-eclampsia; widening health disparities

Introduction

African Americans, Latinx and those of lower socioeconomic status (SES) are disproportionately burdened by cardiovascular disease when compared to non-Hispanic Whites and those of higher SES (Mozumdar and Liguori, 2011; Silva et al., 2008; Steegers, von Dadelszen, Duvekot, & Pijnenborg, 2010). These disparities have been detected at multiple stages of disease progression, from morbidity and mortality to prevalence of pre-cardiovascular disease states such as the metabolic syndrome, which is defined as a cluster of cardio-metabolic factors characterized by central adiposity, dyslipidemia, insulin resistance and hypertension (Grundy, 2015; Smith et al., 2005). Reducing health disparities and their subsequent burden to individuals and society by identifying at-risk populations and understanding mechanisms underlying disparities is a research and clinical priority (Smith, et al., 2005).

Child-bearing women are an important target group for cardiovascular disease prevention and intervention for many reasons. Metabolic syndrome prevalence has been increasing in child-bearing women, and disproportionately so for African Americans and Latinas, as compared to White women (Mozumdar and Liguori, 2011; Ramos and Olden, 2008). Pregnancy can be considered a physiological "stress test" that may reveal risk for cardiovascular disease through development of prenatal cardio-metabolic diseases, i.e. gestational hypertension, gestational diabetes, and preeclampsia, which affect between 2% and 8% of pregnancies (Cain et al., 2016; Catov and Margerison-Zilko, 2016; Kaaja and Greer, 2005; Rodie, Freeman, Sattar, & Greer, 2004). Prenatal cardio-metabolic diseases, although often resolved after childbirth (American Diabetes, 2013; Podymow and August, 2010), can result in lasting physiological damage that increases risk for cardio-metabolic disease postpartum, during subsequent pregnancies, and over the life course (Cain, et al., 2016; Catov and Margerison-Zilko, 2016; Kessous, Shoham-Vardi, Pariente, Sherf, & Sheiner, 2013; Retnakaran et al., 2010; Rodie, et al., 2004; Verier-Mine, 2010). Again, African American/Latina or poorer women are at greater risk for both pregnancy and postpartum cardio-metabolic diseases (Bentley-Lewis et al., 2014; Esakoff, Rad, Burwick, & Caughey, 2016; Eskenazi, Fenster, & Sidney, 1991; Silva, et al., 2008; Steegers, et al., 2010).

Current research tends to approach the subject of a mother's race/ethnicity, SES and prenatal cardio-metabolic disease diagnosis as independent risks for postpartum cardio-metabolic problems. These three factors, however, do not occur in isolation: African American and Latina women are at increased risk for developing prenatal cardio-metabolic diseases (Bentley-Lewis, et al., 2014; Esakoff, et al., 2016; Eskenazi, et al., 1991) and are more likely to be of lower SES (Esakoff, et al., 2016). Moreover, low SES has also been associated with increased risk for developing cardio-metabolic diseases in pregnancy (Silva, et al., 2008; Steegers, et al., 2010). Despite these findings, few studies examine all three risk factors together, and only three studies have explored whether race/ethnicity and prenatal cardio-metabolic diseases interact in predicting risk of postpartum cardio-metabolic health (Bentley-Lewis, Huynh, Li, Wenger, & Thadhani, 2016; Bentley-Lewis, et al., 2014; Kousta et al., 2006).

In a sample of 4,010 women, Latinas who had gestational diabetes were at increased risk of postpartum hypertension compared to non-Latina White women, both with and without gestational diabetes (Bentley-Lewis, et al., 2014). A second study of 850 participants found that women of African-Caribbean descent with gestational diabetes had worse cardio-metabolic risk and increased risk for metabolic syndrome compared to White women with gestational diabetes (Kousta, et al., 2006). A third study of 17,655 women found that abnormal blood glucose during pregnancy was associated with increased postpartum hypertension risk only among African American women, but not among White, Latina or Asian women, independent of maternal education and covariates (Bentley-Lewis, et al., 2016). Although African American and Latina women with a prenatal cardio-metabolic disease (dysregulated blood sugar) had increased postpartum cardio-metabolic risk, only one of these studies controlled for any indicator of SES (Bentley-Lewis, et al., 2016). This raises the question: Does having two or more of these three factors - being poor, African American or Latina, and having had a prenatal cardio-metabolic disease - increase risk of postpartum cardio-metabolic risk beyond their single contributions?

Therefore, the purpose of these analyses is to investigate if race/ethnicity, poverty status, and prenatal cardio-metabolic disease each independently predict cardio-metabolic risk during the postpartum period, and to test interactions among these variables. Latina, non-Hispanic White, and U.S.-born Black (African American) women were recruited by the Community Child Health Network (CCHN) from 5 study sites across the US following the birth of a child. Per capita household income was used to categorize participants into poverty groups relative to the Federal Poverty Line (FPL), and medical chart reviews identified women who had been diagnosed with a prenatal cardio-metabolic disease (i.e., gestational diabetes, gestational hypertension, or preeclampsia). Cardio-metabolic indicators were assessed at 6 and 12 months postpartum. Consistent with past research, we hypothesized that being African American or Latina, living below the poverty level, and a prenatal cardio-metabolic disease in the recent pregnancy would each predict higher cardio-metabolic risk postpartum, compared to non-Hispanic White race/ethnicity, living above the federal poverty level and no prenatal cardio-metabolic disease diagnosis, respectively. We further hypothesized that women with multiple exposures of these risk factors would demonstrate the highest cardio-metabolic risk over the postpartum compared to other women in the cohort.

Methods

Participants

The sample consisted of 1,753 women recruited between 2008 and 2010 from the Community Child and Health Network (CCHN) cohort. The CCHN study was a community-based, participatory research collaboration, which conducted a study of diverse, under-represented, low-income women who were recruited immediately following the birth of a child in one of five sites across the U.S.: Los Angeles, CA; Washington, DC; Baltimore, MD; Lake County, IL; and seven counties in rural eastern North Carolina. Study sites were selected based on epidemiological evidence of maternal and child health disparities, and population characteristics reflective of high proportion of low-income and racial/ethnic minority groups with high morbidities. Eligibility criteria were 18 to 40 years of age; self-identification as non-Hispanic White, African American, or Latina; English or Spanish-speaking; at least 6 month residence in a target zip code; and, so as to be eligible for a follow-up study of a subsequent pregnancy, to have given birth to four or fewer children, and no immediate intention to be surgically sterilized. Additional information on participant recruitment protocols can be found elsewhere (BeLue et al., 2014; O'Campo et al., 2016). Participants provided informed consent, and all research institutions involved in this project obtained approval from respective Institutional Review Boards and ethics committees prior to data collection.

Procedure

Women were assessed using structured interviews in their homes at 1, 6 and 12 months postpartum. Mothers' race/ethnicity and medical chart data on prenatal cardio-metabolic disease diagnosis were obtained at study entry, and participants reported household income at 1 month postpartum. Updates on income and other background variables were collected at each visit thereafter. Postpartum cardio-metabolic indicators were assessed at two time points (6 and 12 months): Resting blood pressure, waist and hip circumference, and dried blood spot (DBS)-derived cholesterol and glycosylated haemoglobin. Of the 2,106 mothers enrolled, 353 (16.8%) did not have medical charts data (N = 318), and 35 were missing cardio-metabolic data collected at home visits. The analytic sample consisted of 1,753 women. Missing participants were slightly older, had lower pre-pregnancy body mass index (BMI), more likely to be below the poverty level (poor group), and were more often of African American race (p's < .05). In the analytic sample, large proportions of poor, African American, and low BMI women remained.

Race/ethnicity, poverty status, and prenatal cardio-metabolic diseases

Participants reported their place of birth and self-identified their race/ethnicity at study entry. Past-year pre-tax household income obtained at 1 month postpartum was used to calculate per capita household income (adjusted for household size). Adjusted household income relative to the Federal Poverty Line (FPL) was used to define poverty status: poor (< 100% of the FPL; $5,141 +/− 8.955 average adjusted per capita household income), near poor (between 100% and 200% of the FPL; $10,152 +/− 8,338), and low income (greater than 200% of the FPL; $32,339 +/− 37,940). Note that 'poor' women had lowest household income and 'low income' women highest household income.

Maternal chart reviews identified women diagnosed with a prenatal cardio-metabolic disease in the recent pregnancy. A diagnosis was indicated if women had either gestational diabetes, gestational hypertension, preeclampsia, or HELLP syndrome (a more severe form of preeclampsia). These prenatal cardio-metabolic disease conditions have been identified as the "metabolic syndrome" of pregnancy (Kaaja and Greer, 2005; Rodie, et al., 2004).

Postpartum cardio-metabolic risk

Metabolic indicators were assessed at 6 and 12 months postpartum. Waist was measured at the navel, and hip at the maximal part of buttocks. Waist-to-hip ratio (WHR) was calculated by dividing the waist by the hip value.

Maternal blood pressure was assessed using a portable, automatic blood pressure machine (HEM-711DLX or HEM-907XL Pro blood pressure monitor, OMRON, Kyoto, Japan). Systolic (SBP) and diastolic blood pressure (DBP) values were used to calculate mean arterial pressure (MAP): MAP = 1/3 SBP + 2/3 DBP.

Non-fasting blood samples were collected from a finger onto a DBS card, which were stored at −30C prior to shipment to ZRT Laboratory (Beaverton, OR) for assessment of glycosylated hemoglobin, total cholesterol and high density lipoproteins (HDL). Glycosylated haemoglobin is a proxy for fasting blood glucose, representing average red blood cell exposure to glucose over the previous 3 months. Immunoturbidimetic assay was used to determine percentage of total haemoglobin that was glycosylated, coefficients of variation (CVs) < 8.5. Higher values indicate greater blood glucose exposure. Non-fasting total cholesterol and HDL (mmol/L) were assessed via enzymatic assay, CVs < 7.1 and 8.7, respectively. The ratio of total cholesterol:HDL was calculated by dividing total cholesterol values by total HDL values. Higher values indicate greater cardiovascular disease risk (Millan et al., 2009).

Zero-order correlations suggested that cardio-metabolic indicators were fairly stable between 6 and 12 months postpartum, average $r = .52$ with a range from .21[1] to .72. Individual cardio-metabolic indicators were each averaged across the two assessments. A cardio-metabolic risk index was then calculated by standardizing MAP, glycosylated haemoglobin, WHR and total cholesterol:HDL and averaging across the z-scored indicators. Values ranged from −1.77 SD to 3.23 SD, with higher values indicating higher postpartum cardio-metabolic risk.

Covariates

Covariates included in each model were maternal age at study entry, medical chart-obtained parity (primiparous vs. multiparous), pre-pregnancy BMI, health behaviours (smoking, alcohol consumption), breastfeeding, maternal employment status, change in employment status over the follow-up, and change in household income over the follow-up. (For details see below).

---

[1]Total cholesterol:HDL ratio was the least stable ($r = .21$), likely due to these samples being non-fasting

Central adiposity is both a symptom and driver of pregnancy and postpartum cardio-metabolic risk and disease (Lee et al., 2015; Sebire et al., 2001), and may differ by race/ethnicity and poverty status (Ng, Cameron, Hills, McClure, & Scuffham, 2014). Pre-pregnancy BMI (kg/m^2) was determined using pre-pregnancy maternal weight and height obtained from maternal chart review.

Maternal health behaviours were assessed at 6 months postpartum. Both alcohol consumption and smoking status are associated with SES and cardio-metabolic risk (Paek, Chun, Jin, & Lee, 2006). Participants were asked whether they consumed alcoholic beverages over a typical week. Because reported alcohol use in this sample was low (average 1.17+/− 3.37 drinks/week), alcohol use was categorized and effect coded as "no alcohol consumption" (−1) or "alcohol consumption" (1). Participants were also asked if they currently smoked, and were categorized as non-smoker (−1) or smoker (1).

Breastfeeding is associated with lower postpartum cardio-metabolic risk and may vary by SES and race/ethnicity (Cordero, Valentine, Samuels, Giannone, & Nankervis, 2012; Countouris et al., 2016; Gunderson et al., 2010; Wiklund et al., 2012). Breastfeeding was assessed at 6 and 12 months postpartum, and coded into three groups as 'never breastfed,' 'breastfed but stopped before 6 months postpartum,' and 'breastfed up to or past 6 months postpartum.'

Mothers' return to work and employment status are associated with socioeconomic factors. Maternal employment status was assessed at 1 month postpartum. Women were coded as working full-time, part-time or not working. At postpartum, women were asked if their employment status had changed over the follow-up. Employment change was coded as 'no change' (0), 'became employed' (1) and 'became unemployed' (−1). At the same time, participants were asked if there had been any change in household income over the follow-up period. Change in household income was coded as 'no change' (0), 'decrease in household income' (−1), or 'increase in household income' (1).

Statistics

The frequency distributions of study variables were inspected for outliers and normality prior to analysis. All analyses were run using SPSS v23 (IBM, 2016). Logistic regression analyses were used to determine whether race/ethnicity or poverty status predicted probability of having being diagnosed with a prenatal cardio-metabolic disease, controlling for pre-pregnancy BMI, maternal age, and parity.

A 3×3×2 analysis of covariance (ANCOVA) was used to assess whether maternal race/ethnicity, poverty group, prenatal cardio-metabolic disease and/or their interactions were associated with average cardio-metabolic risk between 6 and 12 months postpartum. Significant omnibus tests, indicating differences by predictor-defined groups, were followed by graphing the covariate-adjusted or estimated marginal group means and inspecting the estimated marginal group means 95% confidence intervals. Confidence intervals that do not overlap signify significant group differences. Maternal age, parity, pre-pregnancy BMI,

health behaviours, breastfeeding, maternal employment status, change in employment status and change in household income were included as covariates in all models.

Results

Sample characteristics

Descriptive statistics on the sample are presented in Table 1. Approximately half the sample was African American (53%), and 43% had an adjusted household income below the FPL. Nearly one in five women (18%) were diagnosed with a prenatal cardio-metabolic disease over the previous pregnancy. Compared to non-Hispanic White women, the African American and Latina women were more likely to be in the poverty or near-poor groups (36%, 77%, 84% respectively, $\chi^2(4) = 345$, $p < .001$). For White women, adjusted per capita household income was on average $4,215 +/− 2,093 for the poor, $10,036 +/− 2,168 for the near-poor, and $35,280 +/− 1,140 for the low/middle-income groups. For Latina women, adjusted per capita household income was on average $3,174 +/− 1,375 for the poor, $8,070 +/− 1,329 for the near-poor, and $21,488 +/− 2,122 for the low/middle-income groups. And for African American women, adjusted per capita household income was on average $5,007 +/− 838 for the poor, $8,878 +/− 1,255 for the near-poor, and $18,973 +/− 1,271 for the low/middle-income groups.

Predicting odds of prenatal cardio-metabolic disease by race/ethnicity and poverty status

Logistic regression analyses were used to assess whether maternal race/ethnicity or poverty status was associated with probability of a prenatal cardio-metabolic disease, independent of maternal age, parity and pre-pregnancy BMI. Older age, $b = .062$, $SE = .016$, $p < .001$, $OR = 1.06$, and higher pre-pregnancy BMI, $b = .075$, $SE = .010$, $p < .001$, $OR = 1.08$, were associated with greater odds of prenatal cardio-metabolic disease. Compared to White and Latina women, African American women were more likely to have a prenatal cardio-metabolic disease diagnosis, $b = .608$, $SE = .221$, $p = .006$, $OR = 1.84$ (Table 2)

Race/ethnicity, poverty status, and prenatal cardio-metabolic disease

A 3×3×2 ANCOVA was used to assess whether maternal race/ethnicity (African American, Latina, White), poverty status (poor, near poor, low income), and/or previous prenatal cardio-metabolic disease (present/absent) were associated with cardio-metabolic risk between 6 and 12 months postpartum, adjusting for covariates (Table 2).

Main effects were detected by race/ethnicity, $F(2, 769) = 13.4$, $p < .001$, such that African American women had highest, White women lowest, and Latina women had intermediate postpartum cardio-metabolic risk (Figure 1A). Significant main effects were also detected by prenatal cardio-metabolic disease, $F(1, 769) = 24.5$, $p < .001$. Women with a prenatal cardio-metabolic disease had significantly higher postpartum cardio-metabolic risk compared to those who were not diagnosed (Figure 1B). No main effects by poverty category were detected, $F(2, 769) = .507$, $p = .603$.

These main effects were qualified by significant statistical interactions. Maternal race/ethnicity and poverty status significantly interacted, $F(4, 769) = 3.73$, $p = .001$. Among

Latina and White women, the expected socioeconomic gradient was observed, such that poor White and Latina women had a trend towards higher postpartum cardio-metabolic risk compared to White and Latina women in the top income group (low income) (Figure 2). The opposite pattern, however, was observed among African Americans, such that African American women in the poor group had significantly lower postpartum cardio-metabolic risk compared to African American women in the top income group. That is, unlike White and Latina women, no protective effect by greater household income was observed among African American women, and in fact higher income women had higher risk.

Two-way interactions also emerged for prenatal cardio-metabolic disease by race/ethnicity, $F(2, 769) = 8.55, p < .001$, such that African American and Latina women with a prenatal metabolic disease had significantly higher postpartum cardio-metabolic risk compared to African American and Latina women without disease. Furthermore, among women who had a prenatal cardio-metabolic disease, African American women had greater postpartum cardio-metabolic risk than Latina women (Figure 3). Prenatal cardio-metabolic disease did not significantly interact with poverty status to predict postpartum cardio-metabolic risk, $F(2, 769) = 2.91, p = .055$.

The three-way interaction between race/ethnicity, poverty status and prenatal cardio-metabolic diseases was not significant $F(4, 769) = 1.02, p = .396$, independent of covariates.

Discussion

Data collected from a unique cohort of diverse, low-income women was utilized to test whether race/ethnicity, poverty status, and prenatal cardio-metabolic diseases predicted cardio-metabolic risk, individually and interactively, between 6 and 12 months postpartum. Consistent with hypotheses and prior research, cardio-metabolic diseases diagnosed in pregnancy were strong predictors of postpartum cardio-metabolic risk, independent of race/ethnicity and poverty status. Also consistent, African American and Latina women had higher postpartum cardio-metabolic risk compared to non-Latina White women. This result is notable because all women of all ethnicities were of relatively low income and any further variation is controlled in the analyses. Poverty status was not independently associated with postpartum cardio-metabolic risk.

During the child-bearing years, African American and Latina women are more likely to be living in poverty than White women, and both African American race and Latina ethnicity, as well as poverty, have been linked to worse cardio-metabolic health in the general population. Despite these disparities, race/ethnicity and SES are rarely studied together. We were able to do so here in a large cohort because the larger CCHN study targeted specific communities for study with high disparities and low income. We found that race/ethnicity was the stronger predictor of postpartum cardio-metabolic risk, with African American and Latina women having higher postpartum cardio-metabolic risk as compared to White women. Presence of a prenatal cardio-metabolic disease further increased this risk, which is consistent with past research (Bentley-Lewis, et al., 2016; Bentley-Lewis, et al., 2014; Kousta, et al., 2006). This highlights differences in disease risk and burden experienced by African American and Latina women. We note that other groups not assessed here, such as

Filipino women (Steegers, et al., 2010), may also be at increased risk for prenatal and postpartum cardio-metabolic complications, and that future research should examine these associations in other races/ethnicities as well.

African American women emerged as a particularly vulnerable group and did not seem to benefit from higher household income. Compared to White and Latina women, African American women were 84% more likely to have had a cardio-metabolic disease in pregnancy, and had highest postpartum cardio-metabolic risk. Higher household income was expected to confer protection and reduce disparities, but African American women with higher household income had greater cardio-metabolic risk compared to those with lower household income. This "reverse" gradient by socioeconomic resources in African American samples has been observed in other studies, including of SES and inflammation (Beach et al., 2016; Brody et al., 2013) and glycemic control (Wang, Wiebe, & White, 2011). There are also studies showing that, with increasing SES, African American women have either higher or no appreciable decrease in risk for preterm birth, low birthweight infants and infant mortality, as compared to White women (Ahern, Pickett, Selvin, & Abrams, 2003; Braveman et al., 2015; Colen, Geronimus, Bound, & James, 2005; J. W. Collins, David, Simon, & Prachand, 2007; J. W. Collins, Jr. and Hammond, 1996; Gorman, 1999; Lieberman, Ryan, Monson, & Schoenbaum, 1987; Messer, Kaufman, Dole, Savitz, & Laraia, 2006; Messer et al., 2006; Parker, Schoendorf, & Kiely, 1994; Pickett, Ahern, Selvin, & Abrams, 2002; Reagan and Salsberry, 2005; Savitz et al., 2004; Schempf, Kaufman, Messer, & Mendola, 2011; Schoendorf, Hogue, Kleinman, & Rowley, 1992; Singh and Yu, 1995; Slaughter-Acey, Holzman, Calloway, & Tian, 2016; Starfield et al., 1991). Greater chronic stress exposure, including the pernicious effects of structural and personal discrimination with increasing income and education among African American women, has been thought to be a factor (Beach, et al., 2016; Boylan, Lewis, Coe, & Ryff, 2015; Brody, et al., 2013). Insomuch as this sample consisted of all poor to low/middle income women, the results are striking and clearly highlights the unique health challenges faced by African American women and may shed further light on health disparities in maternal health.

Limitations to this study include a lack of detailed data on pre-pregnancy medical history. Further research is needed to understand preconception links to postpartum cardio-metabolic risk. We also do not have information on sub-clinical pregnancy or preconception cardio-metabolic health, such as blood pressure and blood sugar levels. Further research can assess how these indicators interact with race/ethnicity and SES to predict postpartum cardio-metabolic risk. Second, the CCHN cohort is unique in that it is comprised of low SES women, a group traditionally underrepresented in health research. Although we cannot generalize our findings to middle- or higher income women, these results may shed light on health challenges in the context of poverty. Future research may examine a broader SES distribution, especially among African American and Latina women.

In sum, we extended past research by considering whether having multiple demographic and medical risk factors, specifically African American race, Latina ethnicity, poverty, and prenatal cardio-metabolic disease together compound postpartum cardio-metabolic risk. African American women emerged as particularly vulnerable, especially following a prenatal cardio-metabolic disease. We hope that these results further our understanding of

how health disparities and diseases of pregnancy may impact child-bearing women cardio-metabolic health postpartum, with implications for longer term health of women.

References

Ahern J, Pickett KE, Selvin S, & Abrams B (2003). Preterm birth among African American and white women: a multilevel analysis of socioeconomic characteristics and cigarette smoking. J Epidemiol Community Health, 57(8), pp. 606–611. doi:DOI 10.1136/jech.57.8.606 Retrieved from <Go to ISI>://WOS:000184374000021 [PubMed: 12883067]

American Diabetes A. (2013). Diagnosis and classification of diabetes mellitus. Diabetes Care, 36 Suppl 1, pp. S67–74. doi:10.2337/dc13-S067 Retrieved from 10.2337/dc13-S067https://www.ncbi.nlm.nih.gov/pubmed/23264425 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/23264425 [PubMed: 23264425]

Beach SR, Lei MK, Brody GH, Kim S, Barton AW, Dogan MV, & Philibert RA (2016). Parenting, Socioeconomic Status Risk, and Later Young Adult Health: Exploration of Opposing Indirect Effects via DNA Methylation. Child Dev, 87(1), pp. 111–121. doi:10.1111/cdev.12486 Retrieved from 10.1111/cdev.12486http://www.ncbi.nlm.nih.gov/pubmed/26822447 Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/26822447 [PubMed: 26822447]

BeLue R, Schafer P, Chung B, Vance M, Lanzi RG, O'Campo P, & CCHN. (2014). Evaluation of the Community Child Health Research Network (CCHN) Community-Academic Partnership. Journal of Health Disparities Research and Practice, 7, pp. 51–66.

Bentley-Lewis R, Huynh J, Li S, Wenger J, & Thadhani R (2016). Hypertension Risk Subsequent to Gestational Dysglycemia Is Modified by Race/Ethnicity. Hypertension, 67(1), pp. 223–228. doi:10.1161/HYPERTENSIONAHA.115.06360 Retrieved from 10.1161/HYPERTENSIONAHA.115.06360http://www.ncbi.nlm.nih.gov/pubmed/26573715 Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/26573715 [PubMed: 26573715]

Bentley-Lewis R, Powe C, Ankers E, Wenger J, Ecker J, & Thadhani R (2014). Effect of race/ethnicity on hypertension risk subsequent to gestational diabetes mellitus. Am J Cardiol, 113(8), pp. 1364–1370. doi:10.1016/j.amjcard.2014.01.411 Retrieved from 10.1016/j.amjcard.2014.01.411https://www.ncbi.nlm.nih.gov/pubmed/24576544 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/24576544 [PubMed: 24576544]

Boylan JM, Lewis TT, Coe CL, & Ryff CD (2015). Educational Status, Anger, and Inflammation in the MIDUS National Sample: Does Race Matter? Ann Behav Med, 49(4), pp. 570–578. doi:10.1007/s12160-015-9687-2 Retrieved from 10.1007/s12160-015-9687-2https://www.ncbi.nlm.nih.gov/pubmed/25715901 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/25715901 [PubMed: 25715901]

Braveman PA, Heck K, Egerter S, Marchi KS, Dominguez TP, Cubbin C, … Curtis M (2015). The role of socioeconomic factors in Black-White disparities in preterm birth. Am J Public Health, 105(4), pp. 694–702. doi:10.2105/AJPH.2014.302008 Retrieved from 10.2105/AJPH.2014.302008https://www.ncbi.nlm.nih.gov/pubmed/25211759 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/25211759 [PubMed: 25211759]

Brody GH, Yu T, Chen E, Miller G, Kogan SM, & Beach SR (2013). Is Resilience Only Skin Deep?: Rural African Americans' Socioeconomic Status–Related Risk and Competence in Preadolescence and Psychological Adjustment and Allostatic Load at Age 19. Psychol Sci, 24, pp. 1285–1293. [PubMed: 23722980]

Cain MA, Salemi JL, Tanner JP, Kirby RS, Salihu HM, & Louis JM (2016). Pregnancy as a window to future health: maternal placental syndromes and short-term cardiovascular outcomes. Am J Obstet Gynecol, 215(4), pp. 484 e481–484 e414. doi:10.1016/j.ajog.2016.05.047 Retrieved from 10.1016/j.ajog.2016.05.047https://www.ncbi.nlm.nih.gov/pubmed/27263996 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/27263996 [PubMed: 27263996]

Catov JM, & Margerison-Zilko C (2016). Pregnancy as a window to future health: short-term costs and consequences. Am J Obstet Gynecol, 215(4), pp. 406–407. doi:10.1016/j.ajog.2016.06.060 Retrieved from 10.1016/j.ajog.2016.06.060https://www.ncbi.nlm.nih.gov/pubmed/27686037 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/27686037 [PubMed: 27686037]

Colen CG, Geronimus AT, Bound J, & James SA (2005). Maternal Upward Socioeconomic Mobility and Black–White Disparities in Infant Birthweight. Am J Public Health, 96, pp. 2032–2039. doi: 10.2105/AJPH.2005.076547)

Collins JW, David RJ, Simon DM, & Prachand NG (2007). Preterm birth among African American and white women with a lifelong residence in high-income Chicago neighborhoods: An exploratory study. Ethn Dis, 17(1), pp. 113–117. Retrieved from <Go to ISI>://WOS: 000243487000019 [PubMed: 17274219]

Collins JW, Jr., & Hammond NA (1996). Relation of maternal race to the risk of preterm, non-low birth weight infants: a population study. Am J Epidemiol, 143(4), pp. 333–337. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/8633617 [PubMed: 8633617]

Cordero L, Valentine CJ, Samuels P, Giannone PJ, & Nankervis CA (2012). Breastfeeding in women with severe preeclampsia. Breastfeed Med, 7(6), pp. 457–463. doi:10.1089/bfm.2012.0019 Retrieved from 10.1089/bfm.2012.0019https://www.ncbi.nlm.nih.gov/pubmed/22871169 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/22871169 [PubMed: 22871169]

Countouris ME, Schwarz EB, Rossiter BC, Althouse AD, Berlacher KL, Jeyabalan A, & Catov JM (2016). Effects of lactation on postpartum blood pressure among women with gestational hypertension and preeclampsia. Am J Obstet Gynecol, 215(2), pp. 241 e241–248. doi:10.1016/j.ajog.2016.02.046 Retrieved from 10.1016/j.ajog.2016.02.046https://www.ncbi.nlm.nih.gov/pubmed/26945604 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/26945604 [PubMed: 26945604]

Esakoff TF, Rad S, Burwick RM, & Caughey AB (2016). Predictors of eclampsia in California. J Matern Fetal Neonatal Med, 29(10), pp. 1531–1535. doi:10.3109/14767058.2015.1057489 Retrieved from 10.3109/14767058.2015.1057489http://www.ncbi.nlm.nih.gov/pubmed/26212587 Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/26212587 [PubMed: 26212587]

Eskenazi B, Fenster L, & Sidney S (1991). A multivariate analysis of risk factors for preeclampsia. Jama, 266(2), pp. 237–241. [PubMed: 2056625]

Gorman BK (1999). Racial and ethnic variation in low birthweight in the United States: individual and contextual determinants. Health Place, 5(3), pp. 195–207. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/10984575 [PubMed: 10984575]

Grundy SM (2015). Metabolic syndrome update. Trends Cardiovasc Med doi:10.1016/j.tcm.2015.10.004 Retrieved from 10.1016/j.tcm.2015.10.004http://www.ncbi.nlm.nih.gov/pubmed/26654259 Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/26654259

Gunderson EP, Jacobs DR, Jr., Chiang V, Lewis CE, Feng J, Quesenberry CP, Jr., & Sidney S (2010). Duration of lactation and incidence of the metabolic syndrome in women of reproductive age according to gestational diabetes mellitus status: a 20-Year prospective study in CARDIA (Coronary Artery Risk Development in Young Adults). Diabetes, 59(2), pp. 495–504. doi:10.2337/db09-1197 Retrieved from 10.2337/db09-1197https://www.ncbi.nlm.nih.gov/pubmed/19959762 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/19959762 [PubMed: 19959762]

IBM. (2016). IBM SPSS for Windows (Version 24.0). Armonk, NY: IBM Corp.

Kaaja RJ, & Greer IA (2005). Manifestations of chronic disease during pregnancy. Jama, 294(21), pp. 2751–2757. doi:10.1001/jama.294.21.2751 Retrieved from 10.1001/jama.294.21.2751http://www.ncbi.nlm.nih.gov/pubmed/16333011 Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/16333011 [PubMed: 16333011]

Kessous R, Shoham-Vardi I, Pariente G, Sherf M, & Sheiner E (2013). An association between gestational diabetes mellitus and long-term maternal cardiovascular morbidity. Heart, 99(15), pp. 1118–1121. doi:10.1136/heartjnl-2013-303945 Retrieved from 10.1136/heartjnl-2013-303945http://www.ncbi.nlm.nih.gov/pubmed/23749791 Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/23749791 [PubMed: 23749791]

Kousta E, Efstathiadou Z, Lawrence NJ, Jeffs JA, Godsland IF, Barrett SC, … Johnston DG (2006). The impact of ethnicity on glucose regulation and the metabolic syndrome following gestational diabetes. Diabetologia, 49(1), pp. 36–40. doi:10.1007/s00125-005-0058-6 Retrieved from 10.1007/s00125-005-0058-6http://www.ncbi.nlm.nih.gov/pubmed/16341688 Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/16341688 [PubMed: 16341688]

Lee KK, Raja EA, Lee AJ, Bhattacharya S, Bhattacharya S, Norman JE, & Reynolds RM (2015). Maternal Obesity During Pregnancy Associates With Premature Mortality and Major

Cardiovascular Events in Later Life. Hypertension, 66(5), pp. 938–944. doi:10.1161/HYPERTENSIONAHA.115.05920 Retrieved from 10.1161/HYPERTENSIONAHA.115.05920https://www.ncbi.nlm.nih.gov/pubmed/26370890 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/26370890 [PubMed: 26370890]

Lieberman E, Ryan KJ, Monson RR, & Schoenbaum SC (1987). Risk factors accounting for racial differences in the rate of premature birth. N Engl J Med, 317(12), pp. 743–748. doi:10.1056/NEJM198709173171206 Retrieved from 10.1056/NEJM198709173171206https://www.ncbi.nlm.nih.gov/pubmed/3627184 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/3627184 [PubMed: 3627184]

Messer LC, Kaufman JS, Dole N, Savitz DA, & Laraia BA (2006). Neighborhood crime, deprivation, and preterm birth. Ann Epidemiol, 16(6), pp. 455–462. doi:10.1016/j.annepidem.2005.08.006 Retrieved from 10.1016/j.annepidem.2005.08.006https://www.ncbi.nlm.nih.gov/pubmed/16290179 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/16290179 [PubMed: 16290179]

Messer LC, Laraia BA, Kaufman JS, Eyster J, Holzman C, Culhane J, … O'Campo P (2006). The development of a standardized neighborhood deprivation index. J Urban Health, 83(6), pp. 1041–1062. doi:10.1007/s11524-006-9094-x Retrieved from 10.1007/s11524-006-9094-xhttps://www.ncbi.nlm.nih.gov/pubmed/17031568 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/17031568 [PubMed: 17031568]

Millan J, Pinto X, Munoz A, Zuniga M, Rubies-Prat J, Pallardo LF, … Pedro-Botet J (2009). Lipoprotein ratios: Physiological significance and clinical usefulness in cardiovascular prevention. Vascular Health and Risk Management, 5, pp. 757–765. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19774217 [PubMed: 19774217]

Mozumdar A, & Liguori G (2011). Persistent increase of prevalence of metabolic syndrome among U.S. adults: NHANES III to NHANES 1999-2006. Diabetes Care, 34(1), pp. 216–219. doi:10.2337/dc10-0879 Retrieved from 10.2337/dc10-0879http://www.ncbi.nlm.nih.gov/pubmed/20889854 Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/20889854 [PubMed: 20889854]

Ng SK, Cameron CM, Hills AP, McClure RJ, & Scuffham PA (2014). Socioeconomic disparities in prepregnancy BMI and impact on maternal and neonatal outcomes and postpartum weight retention: the EFHL longitudinal birth cohort study. BMC Pregnancy Childbirth, 14, p 314. doi:10.1186/1471-2393-14-314 Retrieved from 10.1186/1471-2393-14-314https://www.ncbi.nlm.nih.gov/pubmed/25201481 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/25201481 [PubMed: 25201481]

O'Campo P, BeLue R, Borenstein H, Reed-Vance M, Lanzi RG, Schafer P, … Woolord R (2016). Issues and Solutions for Collecting Biological Specimen in Longitudinal Studies: Experience from the Community Child Health Network Research Network. J Health Care Poor Underserved, 27(1), pp. 339–351. doi:10.1353/hpu.2016.0021 Retrieved from 10.1353/hpu.2016.0021https://www.ncbi.nlm.nih.gov/pubmed/27763473 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/27763473 [PubMed: 27763473]

Paek KW, Chun KH, Jin KN, & Lee KS (2006). Do health behaviors moderate the effect of socioeconomic status on metabolic syndrome? Ann Epidemiol, 16(10), pp. 756–762. doi:10.1016/j.annepidem.2006.04.012 Retrieved from 10.1016/j.annepidem.2006.04.012https://www.ncbi.nlm.nih.gov/pubmed/16895757 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/16895757 [PubMed: 16895757]

Parker JD, Schoendorf KC, & Kiely JL (1994). Associations between Measures of Socioeconomic Status and Low Birth Weight, Small for Gestational Age, and Premature Delivery in the United States AEP, 4, pp. 271–278. [PubMed: 7921316]

Pickett KE, Ahern JE, Selvin S, & Abrams B (2002). Neighborhood socioeconomic status, maternal race and preterm delivery: a case-control study. Ann Epidemiol, 12(6), pp. 410–418. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/12160600 [PubMed: 12160600]

Podymow T, & August P (2010). Postpartum course of gestational hypertension and preeclampsia. Hypertens Pregnancy, 29(3), pp. 294–300. doi:10.3109/10641950902777747 Retrieved from 10.3109/10641950902777747https://www.ncbi.nlm.nih.gov/pubmed/20670153 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/20670153 [PubMed: 20670153]

Ramos RG, & Olden K (2008). The prevalence of metatabolic syndrome among US women of childbearing age. Am J Public Health, 98, pp. 1122–1127. doi:10.2105/AJPH.2007.120055) [PubMed: 18445796]

Reagan PB, & Salsberry PJ (2005). Race and ethnic differences in determinants of preterm birth in the USA: broadening the social context. Soc Sci Med, 60(10), pp. 2217–2228. doi:10.1016/j.socscimed.2004.10.010 Retrieved from 10.1016/j.socscimed.2004.10.010https://www.ncbi.nlm.nih.gov/pubmed/15748670 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/15748670 [PubMed: 15748670]

Retnakaran R, Qi Y, Connelly PW, Sermer M, Zinman B, & Hanley AJ (2010). Glucose intolerance in pregnancy and postpartum risk of metabolic syndrome in young women. J Clin Endocrinol Metab, 95(2), pp. 670–677. doi:10.1210/jc.2009-1990 Retrieved from 10.1210/jc.2009-1990http://www.ncbi.nlm.nih.gov/pubmed/19926711 Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19926711 [PubMed: 19926711]

Rodie VA, Freeman DJ, Sattar N, & Greer IA (2004). Pre-eclampsia and cardiovascular disease: metabolic syndrome of pregnancy? Atherosclerosis, 175(2), pp. 189–202. doi:10.1016/j.atherosclerosis.2004.01.038 Retrieved from 10.1016/j.atherosclerosis.2004.01.038http://www.ncbi.nlm.nih.gov/pubmed/15262174 Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15262174 [PubMed: 15262174]

Savitz DA, Kaufman JS, Dole N, Siega-Riz AM, Thorp JM, Jr., & Kaczor DT (2004). Poverty, education, race, and pregnancy outcome. Ethn Dis, 14(3), pp. 322–329. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/15328932 [PubMed: 15328932]

Schempf AH, Kaufman JS, Messer LC, & Mendola P (2011). The neighborhood contribution to black-white perinatal disparities: an example from two north Carolina counties, 1999-2001. Am J Epidemiol, 174(6), pp. 744–752. doi:10.1093/aje/kwr128 Retrieved from 10.1093/aje/kwr128https://www.ncbi.nlm.nih.gov/pubmed/21771918 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/21771918 [PubMed: 21771918]

Schoendorf KC, Hogue CJR, Kleinman JC, & Rowley D (1992). Mortality among Infants of Black as Compared with White College-Educated Parents. New England Journal of Medicine, 326(23), pp. 1522–1526. doi:Doi 10.1056/Nejm199206043262303 Retrieved from <Go to ISI>://WOS:A1992HW97200003 [PubMed: 1579135]

Sebire NJ, Jolly M, Harris JP, Wadsworth J, Joffe M, Beard RW, … Robinson S (2001). Maternal obesity and pregnancy outcome: a study of 287,213 pregnancies in London. Int J Obes Relat Metab Disord, 25(8), pp. 1175–1182. doi:10.1038/sj.ijo.0801670 Retrieved from 10.1038/sj.ijo.0801670https://www.ncbi.nlm.nih.gov/pubmed/11477502 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/11477502 [PubMed: 11477502]

Silva LM, Coolman M, Steegers EAP, Jaddoe VWV, Moll HA, Hofman A, … Raat H (2008). Low socioeconomic status is a risk factor for preeclampsia: the Generation R Study. J Hypertens, 26(6), pp. 1200–1208. Retrieved from <Go to ISI>://WOS:000256229800020 [PubMed: 18475158]

Singh GK, & Yu SM (1995). Infant-Mortality in the United-States - Trends, Differentials, and Projections, 1950 through 2010. Am J Public Health, 85(7), pp. 957–964. doi:Doi 10.2105/Ajph.85.7.957 Retrieved from <Go to ISI>://WOS:A1995RG54900014 [PubMed: 7604920]

Slaughter-Acey JC, Holzman C, Calloway D, & Tian Y (2016). Movin' on Up: Socioeconomic Mobility and the Risk of Delivering a Small-for-Gestational Age Infant. Matern Child Health J, 20(3), pp. 613–622. doi:10.1007/s10995-015-1860-5 Retrieved from 10.1007/s10995-015-1860-5https://www.ncbi.nlm.nih.gov/pubmed/26541591 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/26541591 [PubMed: 26541591]

Smith SC, Jr., Clark LT, Cooper RS, Daniels SR, Kumanyika SK, Ofili E, … Hypertension Writing G (2005). Discovering the full spectrum of cardiovascular disease: Minority Health Summit 2003: report of the Obesity, Metabolic Syndrome, and Hypertension Writing Group. Circulation, 111(10), pp. e134–139. doi:10.1161/01.CIR.0000157743.54710.04 Retrieved from 10.1161/01.CIR.0000157743.54710.04https://www.ncbi.nlm.nih.gov/pubmed/15769755 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/15769755 [PubMed: 15769755]

Starfield B, Shapiro S, Weiss J, Liang KY, Ra K, Paige D, & Wang XB (1991). Race, family income, and low birth weight. Am J Epidemiol, 134(10), pp. 1167–1174. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/1746527 [PubMed: 1746527]

Steegers EA, von Dadelszen P, Duvekot JJ, & Pijnenborg R (2010). Pre-eclampsia. Lancet, 376(9741), pp. 631–644. doi:10.1016/S0140-6736(10)60279-6 Retrieved from 10.1016/S0140-6736(10)60279-6http://www.ncbi.nlm.nih.gov/pubmed/20598363 Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/20598363 [PubMed: 20598363]

Verier-Mine O (2010). Outcomes in women with a history of gestational diabetes. Screening and prevention of type 2 diabetes. Literature review. Diabetes Metab, 36(6 Pt 2), pp. 595–616. doi:10.1016/j.diabet.2010.11.011 Retrieved from 10.1016/j.diabet.2010.11.011http://www.ncbi.nlm.nih.gov/pubmed/21163424 Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/21163424 [PubMed: 21163424]

Wang JT, Wiebe DJ, & White PC (2011). Developmental trajectories of metabolic control among White, Black, and Hispanic youth with type 1 diabetes. J Pediatr, 159(4), pp. 571–576. doi:10.1016/j.jpeds.2011.03.053 Retrieved from 10.1016/j.jpeds.2011.03.053https://www.ncbi.nlm.nih.gov/pubmed/21592513 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/21592513 [PubMed: 21592513]

Wiklund P, Xu L, Lyytikainen A, Saltevo J, Wang Q, Volgyi E, … Cheng S (2012). Prolonged breast-feeding protects mothers from later-life obesity and related cardio-metabolic disorders. Public Health Nutr, 15(1), pp. 67–74. doi:10.1017/S1368980011002102 Retrieved from 10.1017/S1368980011002102https://www.ncbi.nlm.nih.gov/pubmed/21859508 Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/21859508 [PubMed: 21859508]

Key messages

- In a sample of poor to low/middle income women, African American women were at significantly greater risk for having a prenatal cardio-metabolic disease (gestational hypertension, gestational diabetes, pre-eclampsia) relative to non-Latina White and Latina women

- A "reverse" socioeconomic gradient was observed in this sample of low-income African American women, such that poor African American women had lower postpartum cardio-metabolic risk compared to African American women with higher incomes and compared to all Latina and White women.
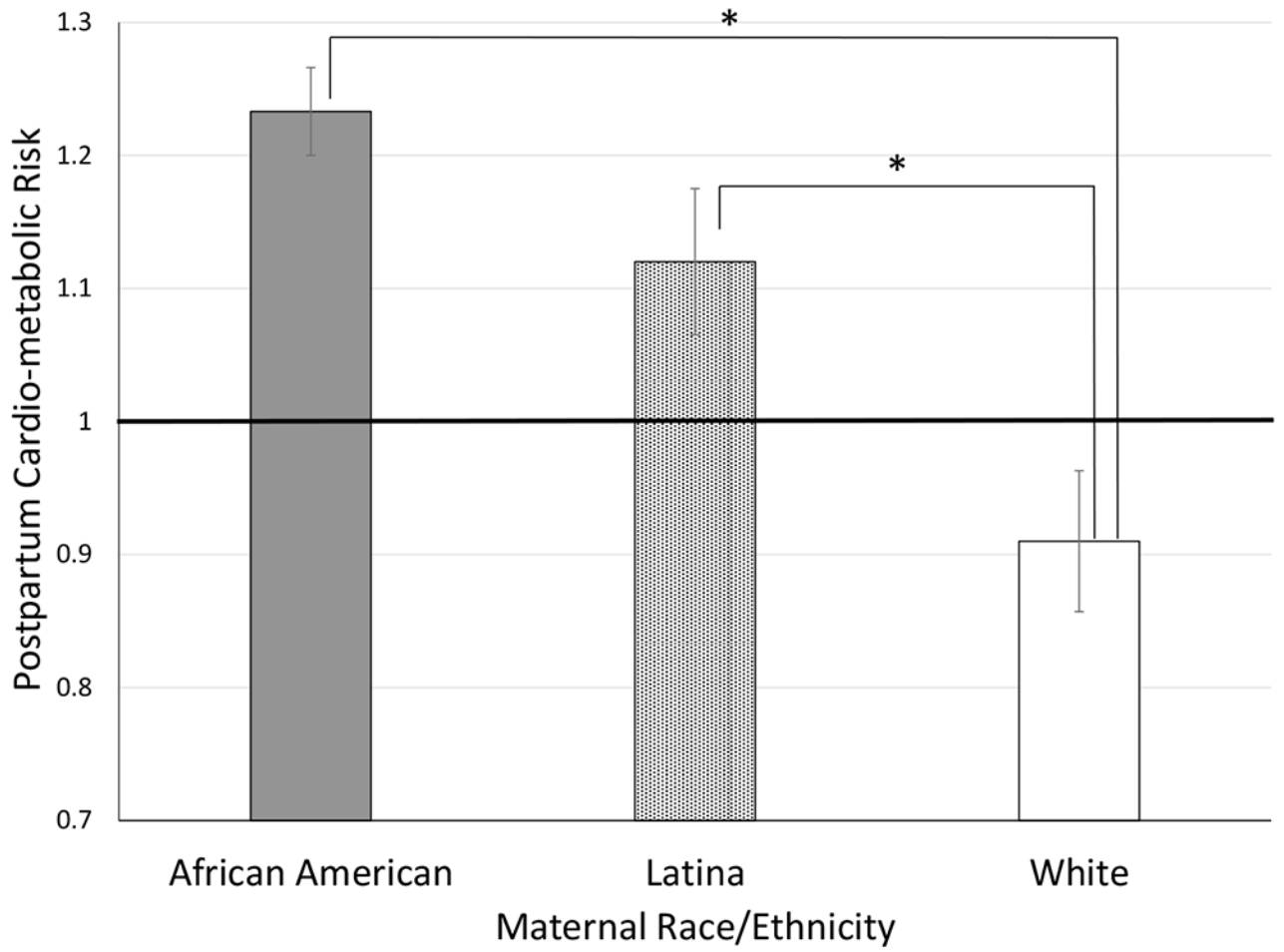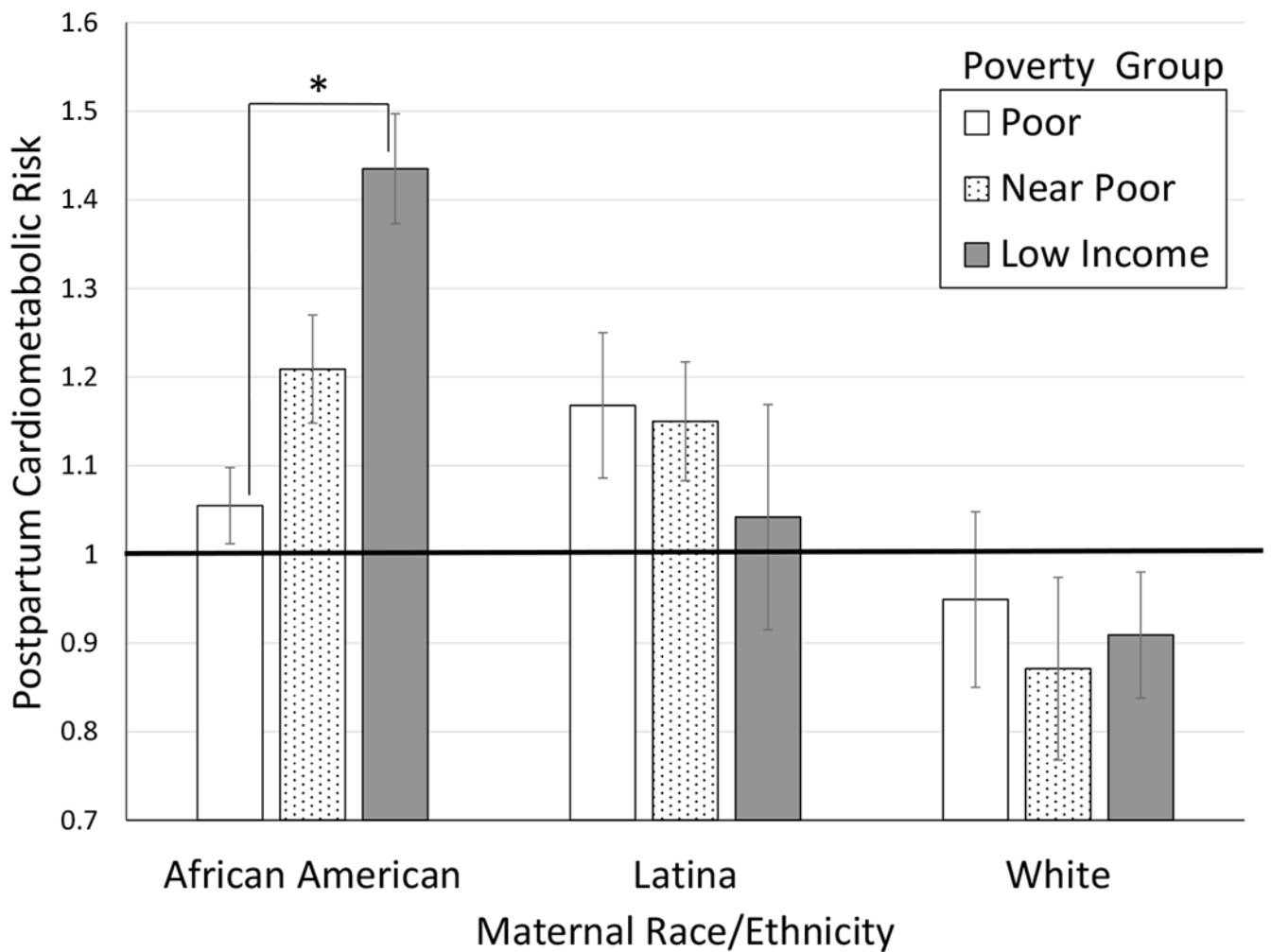
A.
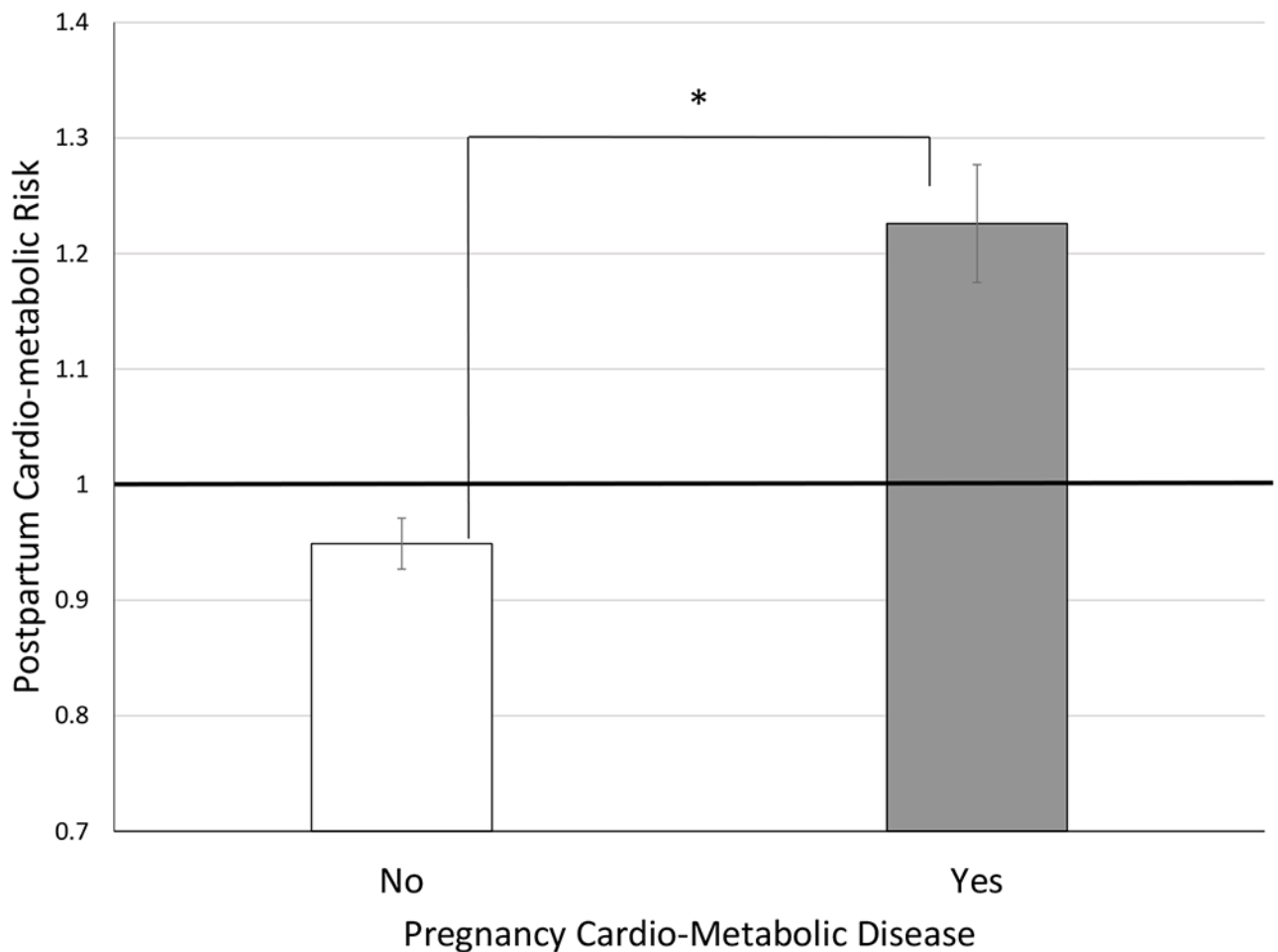
B.

Figure 1.
Graphs of main effects. For graphing purposes, a constant of one was added to all marginal means. Sample average is indicated by the dark line at '1,' and significant group differences by '*.' (A) Average postpartum cardio-metabolic index by maternal race/ethnicity, independent of poverty group, prenatal cardio-metabolic disease diagnosis, and covariates. African American women had highest, $Mn = .233$ SD, $SE = .033$, $.95CI(.169, .297)$, White women lowest $Mn = −.090$ SD, $SE = .053$, $.95CI(−.195, −.014)$, and Latina women intermediate, $Mn = .120$ SD, $SE = .055$, $.95CI(.011, .229)$. (B) Average postpartum cardio-metabolic index by prenatal cardio-metabolic disease (pre-eclampsia/HELLP, gestational hypertension, gestational diabetes) diagnosis, independent of poverty group, race/ethnicity, and covariates. Women with a prenatal cardio-metabolic disease, $Mn = .226$ SD, $SE = .051$, $.95CI(.126, .327)$, had significantly higher postpartum cardio-metabolic risk compared to those who had not, $Mn = −.051$ SD, $SE = .022$, $.95CI(−.094, −.009)$.

Figure 2.
Average metabolic index by the interaction between race/ethnicity and poverty category, independent of prenatal cardio-metabolic disease diagnosis and covariates. Trend towards higher income conferring protection in White and Latina women. However, a "reverse" SES gradient was observed in African American women. Low income African American women had significantly higher postpartum cardio-metabolic risk, $Mn = .435$ SD, $SE = .062$, $.95CI(.313, .556)$ compared to poor African American women, $Mn = .055$ SD, $SE = .043$, $.95CI(−.029, .139)$. For graphing purposes, a constant of one was added to all marginal means. Sample average is indicated by the dark line at '1,' and significant group differences by '*.'
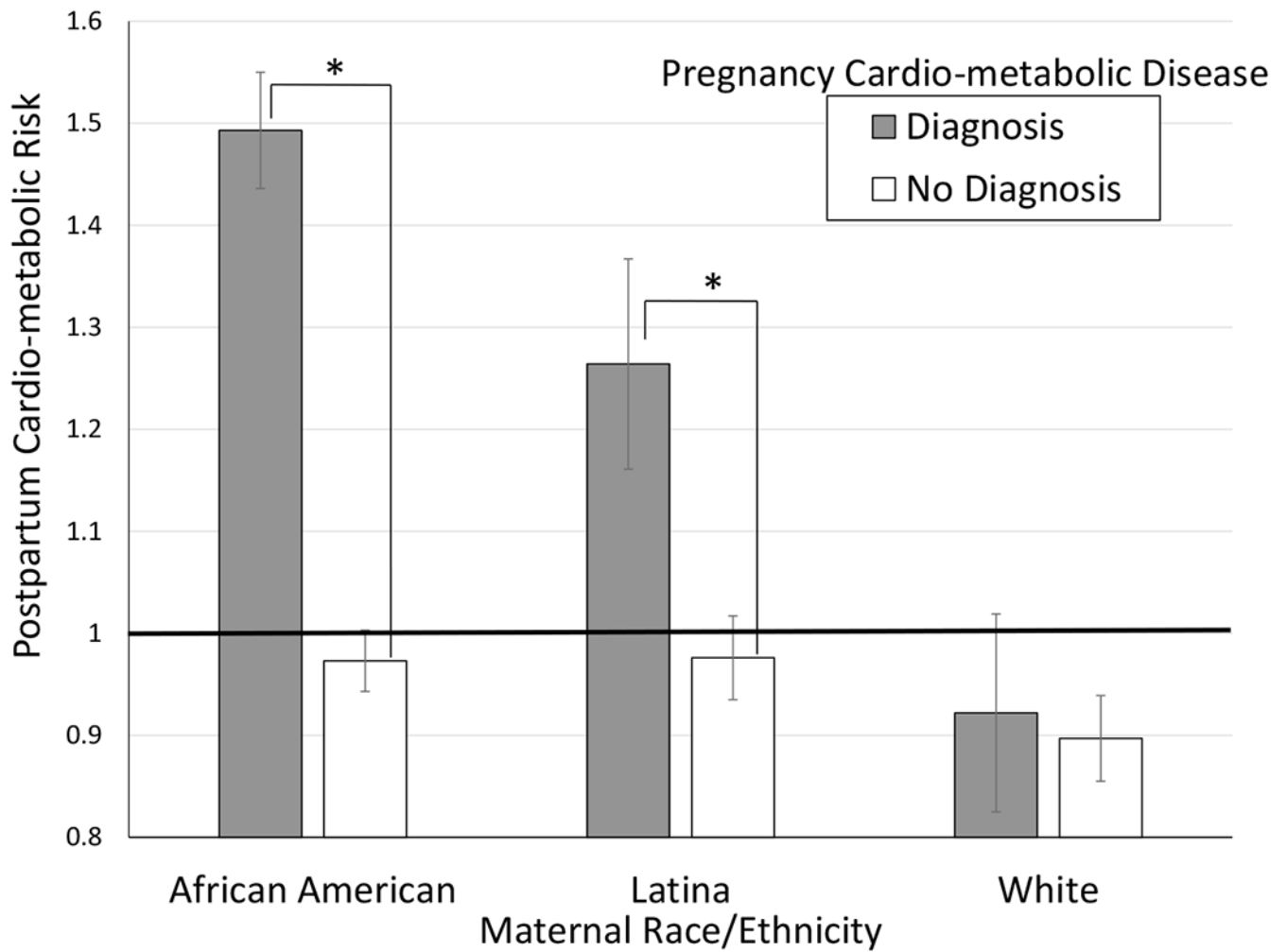
Figure 3.
Average metabolic index by the interaction between prenatal cardio-metabolic disease diagnosis and race/ethnicity, independent of poverty group and covariates. Sample average is indicated by the dark line at '1,' and significant group differences by '*.' African American, *Mn* = .493 SD, *SE* = .057, *.95CI*(.381, .605), and Latina women, *Mn* = .264 SD, *SE* = .103, *.95CI*(.062, .466), with a prenatal cardio-metabolic disease had higher postpartum cardio-metabolic risk compared to women who had not.

Table 1.

Sample characteristics. Metabolic indicators were averaged across the 6 and 12 month postpartum assessments. Prenatal cardio-metabolic diseases were defined as gestational hypertension, gestational diabetes, pre-eclampsia and/or HELLP syndrome. BMI = body mass index; BP = blood pressure; FPL = Federal Poverty Line; HDL = high density lipoprotein

Variable	% (N) or Mn (SD)	Variable	% (N) or Mn (SD)
Age (years)	25.8 (5.72)	Breastfeeding: Never	29% (509)
Pre-pregnancy BMI (kg/m^2)	27.4 (7.25)	Stopped before 6 months postpartum	50% (872)
Parity: Primiparous	45% (871)	Up to or past 6 months postpartum	20% (348)
Alcohol use: Consumes alcohol	32% (539)	Employment status: Not working	78% (1505)
Smoking Status: Non-smoker	81% (1390)	Part-time work	10% (195)
Prenatal cardio-metabolic disease	18 (315)	Full-time work	12% (239)
Change in household income		Employment status change	
Decrease	17 (253)	Became employed	20 (268)
Increase	15 (217)	Became unemployed	27 (373)
Race/Ethnicity: African American	53% (1089)	Poverty Group: Poor (FPL)	43% (885)
Latina	25% (509)	Near poor (100%–200% FPL)	28% (577)
White	23% (465)	Low income (>200% FPL)	29% (601)
Mean cardio-metabolic components			
Waist-hip ratio	.871 (.076)	Total Cholesterol:HDL	4.08 (1.25)
Waist (cm)	94.8 (17.3)	Diastolic BP (mmHg)	73.3 (9.20)
Glycosylated hemoglobin (%)	5.33 (.800)	Systolic BP (mmHg)	111 (10.9)
High density lipoprotein (mmol/L)	2.49 (.701)	Mean Arterial Pressure (mm Hg)	85.9 (9.17)

Table 2.

Results of logistic regression predicting risk of prenatal cardio-metabolic disease (N = 1354).

Variable	b	SE	p	OR
Pre-pregnancy BMI	**.075**	.010	< .001	1.08
Parity	−.297	.159	.062	.743
Age	**.062**	.016	< .001	.004
African American [*]	**.608**	.221	**.006**	1.84
Latina [*]	.127	.243	.602	1.14
Poverty status	−.128	.089	.151	.880

[*] Relative to women of other race/ethnicities.

Table 3.

Results of 3×3×2 ANCOVA predicting postpartum cardio-metabolic risk from maternal race/ethnicity, poverty status and previous prenatal cardio-metabolic disease diagnosis, controlling for age, parity, pre-pregnancy BMI, health behaviours (smoking, alcohol consumption), breastfeeding and maternal postpartum employment status.

	Variable	*F*	*p*
Covariates	Pre-pregnancy BMI	99.6	< .001
	Parity	8.07	.005
	Age	9.10	.003
	Smoking	3.00	.084
	Alcohol consumption	1.43	.232
	Breastfeeding	1.16	.282
	Employment status	.011	.916
	Change in employment status	.745	.388
	Change in household income	.001	.981
Main effects	Race/ethnicity	13.4	< .001
	Poverty group	.507	.603
	Prenatal cardio-metabolic disease	24.5	< .001
2-way interactions	Race/ethnicity × poverty group	3.73	**.005**
	Race/ethnicity × Prenatal cardio-metabolic disease	8.55	**< .001**
	Poverty group × Prenatal cardio-metabolic disease	2.91	.055
3-way interaction		1.02	.396