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Authors

Grobman, William A
Parker, Corette
Wadhwa, Pathik D
[et al.](#)

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Racial/Ethnic Disparities in Measures of Self-reported Psychosocial States and Traits during Pregnancy

William A. Grobman, MD, MBA¹, Corette Parker, DrPH², Pathik D. Wadhwa, MD, PhD³, Marian Willinger, PhD⁴, Hyagriv Simhan, MD⁵, Bob Silver, MD⁶, Ron J. Wapner, MD⁷, Samuel Parry, MD⁸, Brian Mercer, MD⁹, David Haas, MD¹⁰, Alan M. Peaceman, MD¹, Shannon Hunter, MS², Deborah Wing, MD³, Steve Caritis, MD⁵, Sean Esplin, MD⁶, Matt Hoffman, MD¹¹, Jack Ludmir, MD⁸, Jay Iams, MD¹², Emily Long, BS, MA, CCRP¹⁰, George Saade, MD¹³, and Uma M. Reddy, MD, MPH⁴ for the *Eunice Kennedy Shriver National Institute of Child Health Human Development nuMoM2b Network*, Bethesda MD

¹Department of Obstetrics and Gynecology, Northwestern University, Chicago, Illinois ²Division of Biostatistics and Epidemiology, RTI International, Research Triangle Park, North Carolina

³Department of Obstetrics and Gynecology, University of California at Irvine, Irvine, California

⁴Eunice Kennedy Shriver National Institute of Child Health and Human Development, Bethesda, Maryland

⁵Department of Obstetrics and Gynecology, University of Pittsburgh, Pittsburgh, Pennsylvania

⁶Department of Obstetrics and Gynecology, University of Utah Health Sciences Center, Salt Lake City, Utah

⁷Department of Obstetrics and Gynecology, Columbia University, New York, New York

⁸Department of Obstetrics and Gynecology, University of Pennsylvania, Philadelphia, Pennsylvania

⁹Department of Obstetrics and Gynecology, MetroHealth Medical Center, Case Western Reserve University, Cleveland, Ohio

¹⁰Department of Obstetrics and Gynecology, Indiana University, Indianapolis, Indiana

¹¹Department of Obstetrics and Gynecology, Christiana Care Health System, Newark, Delaware

¹²Department of Obstetrics and Gynecology, The Ohio State University, Columbus, Ohio

¹³Department of Obstetrics and Gynecology, University of Texas Medical Branch, Galveston, Texas

Abstract

Background—The aim of this study was to determine whether racial/ethnic differences in psychosocial measures, independent of economic status, exist among a large population of pregnant nulliparas.

Methods—Between October 2010 and September 2013, nulliparous women at eight U.S. medical centers were followed longitudinally during pregnancy and completed validated instruments to quantify several psychosocial domains: Cohen Perceived Stress Scale, trait subscale of the Spielberger Anxiety Inventory, Connor–Davidson Resilience Scale, Multidimensional Scale of Perceived Social Support, Krieger Racism Scale, Edinburgh Postnatal Depression Scale, and the Pregnancy Experience Scale. Scores were stratified and compared by self-reported race, ethnicity, and income.

Results—Complete data were available for 8,128 of the 10,038 women enrolled in the study. For all measures, race and ethnicity were significantly associated ($p < 0.001$) with survey scores. Non-Hispanic black (NHB) women were most likely to score in the most unfavorable category for all measures, with the exception of the Pregnancy Experience Scale. The magnitude of these differences did not differ by income status (interaction, $p > 0.05$) except on the Krieger racism survey and the Edinburgh depression survey, which were exacerbated among NHB women with higher income (interaction, $p < 0.001$).

Conclusion—Significant racial/ethnic disparities, independent of income status, exist in psychosocial measures during pregnancy.

Keywords

psychosocial; stress; disparities; pregnancy

Marked racial and ethnic disparities exist for a variety of adverse obstetric outcomes. For example, non-Hispanic black (NHB) women have significantly higher rates of small for gestational age and spontaneous preterm births than white women.^{1,2} The basis of these disparities, however, remains uncertain and does not appear to be fully explainable by differences in economic status or comorbidities.³

A potential contributor to the racial disparities in obstetric outcomes is differences in stress experienced by different racial and ethnic groups.⁴ Indeed, there are several biologically plausible pathways by which greater stress, particularly if experienced chronically, could lead to obstetric pathology. Such pathways include perturbations in endocrine (i.e., hypothalamic–pituitary–adrenal axis hormones) and immune functions.^{5,6}

The hypothesis that differences in environmental stress may be at least partly responsible for racial disparities in adverse obstetric outcomes, such as preterm birth, would be supported by evidence that pregnant black women perceive more stressful events, and have a worse psychosocial milieu, than their white, Hispanic, and Asian counterparts. In this multicenter study of a large, geographically, and socioeconomically varied population of nulliparous pregnant women, we sought to determine whether there are racial/ethnic differences in self-reported psychosocial measures during pregnancy and whether these differences are affected by economic status.

Methods

Between October 2010 and September 2013, investigators at eight medical centers in the United States performed a prospective observational cohort study, the Nulliparous Pregnancy Outcome Study: Monitoring Mothers to Be (nuMoM2b), in which 10,038 women were followed longitudinally through their first pregnancy. These participants were from geographically varied regions, with 29.4% enrolled in the northeast, 41.1% enrolled in the midwest, and 29.5% enrolled in the west. Participant characteristics, biospecimens, and questionnaire data were collected by trained research personnel during three antepartum study visits. These visits occurred between 6^{0/7} and 13^{6/7} weeks' gestation (Visit 1), 16^{0/7} and 21^{6/7} weeks' gestation (Visit 2), and 22^{0/7} and 29^{6/7} weeks' gestation (Visit 3). All

centers obtained Institutional Review Board approval and all participants provided written informed consent. Full details of the study have been described previously.⁷

This analysis focuses on several psychosocial domains theorized to be associated with adverse pregnancy outcomes. These domains were quantified with previously validated measures. Specifically:

1. Perceived stress was measured using the Cohen 10-item Perceived Stress Scale (PSS)⁸ at Visits 1 and 3. Items are reverse coded, as necessary, so that higher values for each item indicate more perceived stress. Items, coded 0 to 4, are summed to compute a total score ranging from 0 to 40. All items are required for the instrument to be scored.
2. Trait anxiety was assessed at Visit 1 using the trait subscale of the Spielberger State-Trait Anxiety Inventory.⁹ The subscale includes a series of 20 statements for which the participant indicates a response from 1 to 4. Items are reverse coded, as necessary, so that higher values for each item indicate greater anxiety. A total score is computed as an average of the nonmissing items multiplied by 20 and a score can only be obtained if no more than one item is missing. Possible values of the total score range from 20 to 80.
3. Personal resiliency was assessed at Visit 2 using the Connor–Davidson Resilience Scale.¹⁰ This instrument has 25 items, each with a 5-point Likert response scale. The scale developers determined that there were five factors in the scale reflecting: personal competence, high standards, and tenacity; trusts in one's instincts, tolerance to negative affect, and strengthening effects of stress; positive acceptance of change and secure relationships with others; control; and spiritual influences. The 25 items are summed to compute a total score ranging from 0 to 100; all items required a response for the instrument to be scored.
4. Perceived social support was measured using the 12-item version of the Multidimensional Scale of Perceived Social Support at Visit 1.¹¹ Each item is rated on a 7-point Likert-type scale. The items can be combined into three subscales representing perceived social support from family, friends, and significant others. In our analysis, the 12 items are summed to compute a total score ranging from 12 to 84, and all items required a response for the instrument to be scored.
5. Experiences of racial/ethnic discrimination were assessed at Visit 2 using the situation subscale of the Krieger Racism Scale.¹² This instrument asks discrimination in nine different situations—at school, getting a job, at work, getting housing, getting medical care, on the street or in a public setting, from police or in the courts, getting service in a store or restaurant, and getting credit, bank loans, or a mortgage. The total score ranges from 0 to 9 for the number of situations where racism has been experienced.
6. Symptoms of depression were assessed at Visits 1 and 3 using the 10-item Edinburgh Postnatal Depression Scale.¹³ Items are reverse coded, as necessary, so that higher values for each item indicates more negative feelings or

experiences. Items, coded 0 to 3, are summed to compute a total score ranging from 0 to 30. All items are required for the instrument to be scored.

7. Daily stressors that may have been experienced during pregnancy were measured at Visit 3 with the brief version of the Pregnancy Experience Scale (PES-Brief), which documents the most frequently endorsed hassles and uplifts.¹⁴ Each item is rated on a 4-point Likert scale with values of 0 to 3. The items are combined into a set of six scores—frequency of hassles, frequency of uplifts, intensity of hassles, intensity of uplifts, hassles to uplifts frequency ratio, and hassles to uplifts intensity ratio. In the present analysis, the ratio measures are reported.

A psychometric analysis was conducted on each instrument, showing that the scales performed well among the sample as a whole, with acceptable to very high internal consistency reliability demonstrated by Cronbach alphas (data not shown).

A woman's self-identified race/ethnicity was categorized as non-Hispanic white, NHB, Hispanic, Asian, or not defined by one of the other four categories (other). The psychosocial measures were compared according to these race/ethnicity categories. For most measures, these comparisons were made based on whether a woman's score was in the quartile that reflected the greatest psychosocial burden (e.g., the greatest perceived stress or the least social support). In the case of the Edinburgh depression survey, a participant was categorized according to whether her score was 10 or more or whether she endorsed suicidal ideation given that this is a recognized cutoff and a response, respectively, that indicate a greater risk of clinical depression. For the Krieger racism instrument, because the upper quartile of the population had a score of 0, a score of 3 or more was used to define those with the greatest perceived exposure to racism.

After the initial comparison of scores according to race/ethnicity, a further assessment was performed to determine whether any observed association between race/ethnicity and the survey results was modified by economic status (i.e., whether there was any interaction between race/ethnicity and low-income status). Economic status was categorized as "low income" if the family income was approximated to be $\leq 200\%$ of the poverty level for household size using the 2013 Federal Poverty Levels for the 48 contiguous states and the District of Columbia.¹⁵ This determination, at Visit 1, was based on the self-reported total family income category for the past 12 months and the number in the household. The midpoint of the reported income category was used as the approximate family income.

Associations were assessed using logistic regression models on the subset of women who had completed at least one survey and had both race/ethnicity and income data available. In addition, various assessments were conducted to account for missing data, including use of Cochran–Mantel–Haenszel tests of general association across strata and multiple imputation techniques. A fully conditional specification logistic regression was used to generate five datasets with low-income status imputed using insurance status, education level, age category, and marital status of the mother when income was not reported. From these five imputations, results were combined for statistical inference. All tests were performed at a nominal significance level of 0.05. No correction was made for multiple comparisons.

Analyses were conducted using SAS/STAT software, version 9.3 or higher (SAS Institute Inc., Cary, NC).

Results

Scores of psychosocial measures and race/ethnicity were available on 10,010 of the 10,038 women enrolled in the study (99.7%). However, 1,882 (18.8%) of these women chose not to report their income, leaving 8,128 women available as the study population for the primary analysis. This population was racially and ethnically diverse, in proportions similar to those in the United States overall. Two thousand four hundred and sixty-six (30.3%) women were low income. The racial and ethnic composition of the population, stratified by low-income status, is presented in Table 1.

Descriptive data for the psychosocial measure scores are presented in Table 2. Table 3 presents the scores dichotomized after stratification by race/ethnicity. Race/ethnicity was significantly associated with psychosocial scores. Specifically, NHB women generally were most likely to score in the most unfavorable category. They were more likely to be in the category indicating the greatest perceived stress, trait anxiety, perception of racism, ratio of the intensity of hassles to uplifts, and depression, while also being most likely to be in the category with the least social support. On the pregnancy experience survey, Asian women were most likely to have the highest ratio of the frequency of hassles to uplifts; they were also most likely to have the least resilience (i.e., score in the lowest quartile) on the Connor-Davidson measure.

With two exceptions, low-income status did not alter the association between race/ethnicity and the psychosocial scores (interaction term $p > 0.05$). There was an interaction between low-income status and race/ethnicity with regard to the scores for the Edinburgh depression scores at the third visit and the Krieger racism scores at Visit 2. Specifically, in both cases, the magnitude of these differences was exacerbated among NHB women with higher income (Table 4).

Finally, we reviewed the characteristics of the 1,882 women who chose not to report their income versus the 8,128 who did and found that higher percentages of NHB and Hispanic women did not report income. Even after adjustment for the reporting of income, the associations of the psychosocial measures with race/ethnicity remained significant. In addition to the significant interactions that were found previously, analysis with imputed data showed an interaction between race/ethnicity and income for depression and perceived stress at Visit 1. Specifically, the difference between NHB women and non-Hispanic white women was exacerbated among women with higher income (data not shown).

Comment

In this analysis, we have elucidated how a large population that is geographically and racially/ethnically diverse responds to several validated instruments that assess different domains of psychosocial experience. The distributions of scores vary significantly by race/ethnicity, with NHB women providing responses that reflect greater psychosocial burden across almost all domains. Moreover, this burden was not mitigated by income status. In

fact, NHB women of higher income status demonstrated a disparity in depressive symptoms and experiences of racism that was exacerbated compared with their lower income counterparts.

In this analysis, we did not adjust for other demographic factors that also may have differed between the groups, such as body mass index, substance or medication use, or marital status. This decision was made given that the primary aim of the study was to elucidate whether psychosocial experience differed among pregnant women of different race/ethnicity regardless of income. The analysis performed answers this specific question. Other factors may very well differ between groups as well but may be either on the causal pathway to or a consequence of the psychosocial states evaluated. As such, adjustment for their presence may obscure rather than clarify the relationship with race/ethnicity that exists.

These disparities have potentially important clinical relevance with regard to the persistent racial/ethnic disparity in adverse pregnancy outcomes. It is well established that NHB women have greater rates of hypertensive disease of pregnancy, preterm birth, low birth weight neonates, and perinatal mortality.^{1–3,16–18} Reasons for these disparities, however, remain unclear. Although some have proposed genetic factors, such as polymorphisms, as an important underlying contributor, evidence that a heritable etiology accounts for a significant proportion of the marked racial/ethnic disparity that exists is lacking.^{18,19} An alternate hypothesis is that a differentially adverse psychosocial environment leads to derangements of physiologic pathways involved in obstetric and perinatal health.^{20,21}

Our data support the concept that NHB pregnant women experience a pervasive disparity in psychosocial burden—including perceived stress, racism, coping, social support, anxiety, and depression—that mirrors the disparity in adverse pregnancy outcomes. As with the disparity in adverse pregnancy outcomes, the disparity in psychosocial experience is not merely a product of low-income status. Indeed, it appears that for some measures, disparity is actually exacerbated in NHB women with higher income.

Other investigators also found that NHB pregnant women demonstrate greater psychosocial burden.^{4,22–25} However, these studies have been smaller, from a single geographic location, or have focused on a single construct or measure. In contrast, data in this study were derived from more than 8,000 women across the United States, with a racial/ethnic distribution similar to that of the country's population, and included assessments of multiple psychosocial domains.

The study population, moreover, was uniformly nulliparous. Responses of nulliparous women to these instruments may not mimic the responses of their parous counterparts. Indeed, investigators have shown different trajectories of stress and anxiety based on parity.²⁶ Few prior studies have focused on women in this group, who are at particular risk for adverse pregnancy outcomes.²⁷ Moreover, not only is their risk of adverse outcomes relatively high but also it is difficult to gauge given their lack of obstetric history. Thus, these data provide information about the psychosocial experience of nulliparous women and can help provide insight about the social determinants that may contribute to their preterm birth and adverse pregnancy outcome risk.

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Table 1

Distribution of race/ethnicity by economic status of the study population

Characteristic	N	Non-Hispanic white		Non-Hispanic black		Hispanic		Asian		Other	
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Lower income (< 200% poverty level)	2,466	1,127 (45.7)	583 (23.6)		536 (21.7)	48 (1.9)				172 (7.0)	
Higher income (> 200% poverty level)	5,662	4,300 (75.9)	281 (5.0)		534 (9.4)	320 (5.7)				227 (4.0)	
Total population	8,128	5,427 (66.8)	864 (10.6)		1,070 (13.2)	368 (4.5)				399 (4.9)	

Table 2

Descriptive data for the psychosocial measures

Psychosocial measures	Visit	N	Mean	Standard deviation	Minimum	Percentiles			Maximum
						25th	50th	75th	
Edinburgh depression	1	7,903	5.6	4.1	0.0	3.0	5.0	8.0	26.0
	3	7,426	5.4	4.0	0.0	2.0	5.0	8.0	28.0
Krieger racism	2	7,690	0.5	1.1	0.0	0.0	0.0	0.0	9.0
Cohen Perceived Stress	1	8,099	12.4	6.5	0.0	8.0	12.0	16.0	39.0
	3	7,540	11.1	6.3	0.0	7.0	10.0	15.0	40.0
Pregnancy hassles/uplifts									
Frequency ratio	3	7,148	0.7	0.4	0.0	0.4	0.7	0.9	8.0
Intensity ratio	3	6,862	0.6	0.3	0.3	0.4	0.6	0.8	3.0
Spielberger Trait Anxiety	1	7,182	33.5	8.5	20.0	27.0	32.0	38.0	74.0
Perceived Social Support	1	7,200	75.1	13.7	12.0	72.0	80.0	84.0	84.0
Connor–Davidson Resilience	2	7,531	79.8	11.3	0.0	73.0	80.0	88.0	100.0

Table 3

Percentage of women in worst category of psychosocial measures by race/ethnicity

Psychosocial measures	Visit	N	Race/Ethnicity				p-Value ^a	
			Non-Hispanic white (N = 5,427)	Non-Hispanic black (N = 864)	Hispanic (N = 1,070)	Asian (N = 368)		Other (N = 399)
Edinburgh depression 10 or endorsement of suicidal ideation	1	7,903	13.8	26.5	22.9	18.3	21.0	< 0.0001
	3	7,426	14.1	23.1	16.9	16.7	16.3	< 0.0001
Krieger racism 3	2	7,690	2.0	21.0	13.2	15.8	15.8	< 0.0001
Cohen Perceived Stress 75th percentile	1	8,099	23.7	46.0	35.1	32.9	39.8	< 0.0001
	3	7,540	23.6	40.5	32.0	27.2	31.3	< 0.0001
Pregnancy hassles/uplifts								
Frequency ratio 75th percentile	3	7,148	27.5	24.0	27.5	33.6	30.8	0.0156
Intensity ratio 75th percentile	3	6,862	24.1	33.6	26.6	25.6	31.3	< 0.0001
Spielberger Trait Anxiety 75th percentile	1	7,182	26.1	37.4	31.1	31.2	31.5	< 0.0001
Perceived Social Support 25th percentile	1	7,200	22.6	42.5	29.3	27.9	30.4	< 0.0001
Connor–Davidson Resilience 25th percentile	2	7,531	26.6	25.9	28.3	37.8	26.4	0.0002

^a p-Value for the significance of differences in the percentages by race/ethnicity.

Table 4

Percentage of women in worst category of psychosocial measures by race/ethnicity and income category

Psychosocial measures	N	Non-Hispanic white	Non-Hispanic black	Hispanic	Asian	Other	p-Value for interaction ^a
		(N = 5,427)	(N = 864)	(N = 1,070)	(N = 368)	(N = 399)	
Edinburgh depression 10 or endorsement of suicidal ideation at Visit 3							
Lower income (< 200% poverty level)	2,184	23.6	26.2	20.4	31.0	27.9	0.0462
Higher income (> 200% poverty level)	5,242	11.6	16.5	13.5	14.6	7.9	
Krieger racism 3 at Visit 2							
Lower income (< 200% poverty level)	2,303	2.3	14.4	14.0	15.2	17.1	<0.0001
Higher income (> 200% poverty level)	5,387	1.9	35.8	12.5	15.8	14.8	

^a p-Value for interaction between race/ethnicity and income category on the psychosocial measure.