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The Development of the *Healthy Pregnancy Stress Scale*, and Validation in a Sample of Low-Income African American Women

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Abstract

Objectives—The association of stress with pregnancy health is well-known. However, few studies take a mixed methods approach to understand the stressors contributing to a woman's pregnancy-related stress. Among African American women, exposure to stressors during pregnancy likely contributes to disparities in pregnancy health outcomes. This work aimed to understand the types and magnitude of stressors African American women are exposed to during pregnancy.

Methods—Using a mixed methods research design, we developed and administered the *Healthy Pregnancy Stress Scale* (HPSS) to measure stressors within the stress environment of African American women living in poverty.

Results—Exploratory factor analysis (EFA) with one random split-half sample (N=85) identified a two-factor model. Factor 1, defined as general pregnancy stressors, had significant loadings for ten items that ranged in magnitude from 0.319–0.724. Factor 2, defined as relationship strain, had significant loadings for three items ranging in magnitude from 0.613–0.856. Confirmatory factor analysis (CFA) in the second random split-half sample (N=88) showed a strong fit for the two factor model with factor loadings similar in magnitude. Standard fit statistics and those that adjust for item non-normality suggested an adequate fit to the data (RMSEA=0.057, CFI = 0.947, TLI = 0.932; Satorra-Bentler RMSEA= 0.037, CFI = 0.972, TLI = 0.965).

Conclusions for Practice—Our measurement tool may provide a way to determine differences in pregnancy stress experiences across diverse populations of women. Future research should include a test for construct validity by correlating the scale with other measures that should have a specific directional relationship in diverse populations.

Keywords

Pregnancy Stress; Reproductive Health; Health Inequities; Methods

Introduction

Antenatal or prenatal psychosocial stress, which is defined as stress experienced during pregnancy, is consistently linked to stress mechanisms that negatively affect fetal development, birth outcomes, maternal development and postnatal maternal and child health outcomes^{1–3}. Furthermore, prenatal psychosocial stress is associated with maternal depression, panic disorders, drug use, and domestic violence⁴ all of which are linked to more negative fetal and early child development outcomes⁴. Combined, this suggests that understanding psychosocial stress during pregnancy is very important for pregnancy health. This is particularly critical for low-income African American women who disproportionately experience the greatest disparities in negative outcomes known to be affected by pregnancy stress⁵.

A large number of inventories have been used to study the association between prenatal psychosocial stress and pregnancy health; however, many frequently used measures were not designed to capture prenatal pregnancy stress specifically⁶. For example, stress during pregnancy often is measured with multidimensional psychosocial inventories measuring mental health^{7,8}. Correlations exist between such scales measuring depression, anxiety, and pregnancy health^{9,10}. Pregnancy associated risk factors such as depression and anxiety are also associated with a variety of environmental factors such as social networks or other access points for support that tend to be associated with mental illness. Understanding pregnancy health at the intersection of race and class requires taking a more granular approach to understanding factors specifically contributing to the pregnancy stress. From this theoretical framing, exactly which stressors are disproportionately influencing disparities in stress exposure during pregnancies can be better understood. Intervention pathways could then be better informed with more granular understandings of these environmental exposures.

Generally, mixed methods approaches are often used to develop inventories that capture emic, or qualitative, depictions of exposures. The domains that emerge from this inductive approach can then inform quantitative scales that are validated psychometrically¹¹. Currently, this approach has not been taken in the context of pregnancy stress, that includes a range of experiences including low-income African American women. Mixed methods scale development approaches have been used to understand gendered racism^{12,13} and associations with pregnancy health¹⁴. What is not captured within such scales are structural factors or stressors that may not be a product of overt or explicit discrimination but might be disproportionately represented as a harmful exposure experienced at the intersection of race, class and gender. Alternatively, measures that have focused on pregnancy-related stressors have not been validated in a sample of low-income African American women¹⁵. Yet, relationships have been reported between pregnancy stress, racial disparities in risk factors,¹⁶ and birth outcomes¹⁷ with low-income African American women often faring the worst⁵. Low-income African American women are being studied but it is not clear their stress environment is being adequately understood.

In this study, we took an exploratory sequential mixed methods approach, beginning with a grounded theory approach¹⁸ to identifying pregnancy stressors, to develop a unique measure

of comprehensive pregnancy-related stressors. We also validated this measure in a population of low-income African American women. We conducted a split half exploratory/confirmatory factor analysis to assess the construct structure and validity within the target population.

Methods

Settings

The data for this study were collected from women recruited at DeKalb Medical Center, Emory-Crawford Long, Grady Hospital, and a Women, Infant, and Children (WIC) clinic in Fulton County, Georgia. The WIC program is governed by the Food and Nutrition Services of the US Department of Agriculture¹⁹. This program provides benefits to low-income pregnant and postpartum women, and to infants and young children from birth to five. Interviews of eligible consenting mothers were conducted at their convenience either while they were in the hospital because of delivery or while visiting the WIC clinic after delivery.

A total of 282 participants took part in this study. One hundred women were recruited between May 2013 and July 2013. Of these women, 80 completed the open-ended interview questions. This sample included 20 African American receiving Medicaid, 20 African American women with private insurance, 20 White women receiving Medicaid, and 20 White women with private insurance. Open-ended questions were conducted to identify stressor themes across these demographic groups.

Twenty women recruited in 2013 completed the HPSS inventory questions along with 158 participants recruited between May 2015 and July 2015. These participants were all low-income (at or below 185% of the U.S. Poverty Income Guidelines), self-identified as African American, from 18 to 35 years of age, who gave birth within five years prior to the interview, and were English speaking. The analysis is based on open-ended responses from 80 women and inventory responses from 178 participants with complete data. The [Blinded] University Institutional Review Board (IRB00078029), the Division of Health and Wellness of the Fulton County Health Department, DeKalb Medical Center, Emory-Crawford Long, and Grady Hospital all approved this study.

Study design

Item development

Details of Open-Ended Stress Question: Using a modified grounded theory approach¹⁸, we asked a diverse group of 80 mothers about their experiences of stress during their most recent pregnancy. For example, each woman was asked “*What were the most stressful things you experienced during your pregnancy?*” Interviewers probed women’s responses until no more information was provided. A response matrix was used to generate the proportion of respondents mentioning each stressor theme²⁰. This was the basis for developing the Healthy Pregnancy Stress Scale (HPSS) questions. These 18 themes were structured into questions that were then administered to a population of low-income African American women to determine the structure and validity of this measure in this target population (See Appendix A)²¹.

Health Pregnancy Stress Scale Development: The items identified during the open-ended question phase of the study were structured into questionnaire items (See Appendix A). Low-income African American women (n= 178) were asked to score their experience of the items during their last pregnancy based on a Likert scale with 1 = *not at all a source of stress during my last pregnancy* to 6 = *very high source of stress during by last pregnancy*. Item 13 defined as *My partner was absent due to military service* was not included in the analysis because no participants in this study group had partners in the military. The analysis was conducted with the 17 remaining items. All interviews were conducted in a private room with a trained interviewer. Participants self-reported their age, race, education level, and marital status. Pregnancy health information also was collected via self-report and through clinic medical records. Reliability of the 17 items was adequate in this sample, with an inter-item covariance of 0.68, and a scale reliability coefficient of 0.82.

Data analysis

Given the ordinal response options for each item, correlations were estimated in the sample to assess the level of association between any two items (N=178)²². This Pearson's correlation matrix and the Cronbach's alpha were the basis for the factor analyses.

Exploratory and Confirmatory Factor Analyses—Each participant was randomly assigned to the exploratory factor analysis (EFA) or the confirmatory factor analysis (CFA) analysis group using the eigen function in STATA. This procedure randomly assigns either a 1 or a 2 in equal numbers across the 178 participants. Group 1 were included in the EFA analysis and group 2 were included in the CFA analysis. We used EFA^{23–25} to assess the scale's dimensionality (one or two factors), factor loadings for the 17 items, and fit indices, including the root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker-Lewis index (TLI)²². CFA was performed to test the 2 factor model of the HPSS. The fit indices used to evaluate the overall model were the Chi-square model fit and those described above. We report these statistics using the Satorra-Bentler adjustment since distribution of the scale items was non-normal²⁶. All results were analyzed using STATA, Version 14²⁷.

Results

Characteristics of the Sample

The mean age of participants (N=178) was 28 years (SD = 5.89, range 18–45) (Table 1). A majority were married (10.8%) or in a relationship (46.2%). The education variable was dummy coded (less than high school = 0 [17.7%], completion of high school or greater = 1 [82.3%]). A majority of women also had at least one child in the home (Mean = 2.03, SD = 1.29).

Distributions and bivariate association of scale items

Individual item mean scores ranged from 1.25 to 2.83 (Table 2). In general, items relating to partner dynamics and items relating to health concerns had the highest reported means. *Strained relationship with partner* had the highest mean response and the highest number of significant correlations (Table 2). Stress due to *My partner was not supportive and available*

to me during pregnancy had the third highest mean response next to *The worry about the health of my baby became a source of stress during pregnancy*. Means were lowest for *During pregnancy I was treated poorly by my health care providers* (1.21) and *I had difficulty finding help with other children when I needed it during pregnancy* (1.25), the latter item was significantly correlated with 11 of the 17 items.

Exploratory and Confirmatory Factor Analysis Results

The one-factor RMSEA ($=0.088$; Satorra-Bentler $= 0.072$) implied an inadequate fit to the data (CFI $= 0.869$, TLI $= 0.838$; Satorra-Bentler CFI $= 0.893$ TLI $= 0.867$) (Table 3). In the two-factor model, four items not loading on either factor were removed: *My partner was not available during pregnancy because he worked too much* (factor 1 loading: 0.30, factor 2 loading: 0.07), *During pregnancy I did not want to be pregnant* (factor 1 loading: 0.11, factor 2 loading: 0.29), *During pregnancy I was treated poorly by my health care providers* (factor 1 loading: 0.25, factor 2 loading: -0.22) and *It was stressful having other family members staying with me while I was pregnant* (factor 1 loading: 0.28, factor 2 loading: 0.03).

Because of strongly positive loadings, adequate fit indices (RMSEA close to 0.06 or less; CFI close to 0.95 or greater; TLI close to 0.95 or greater)²⁸, and theoretical interpretation, we retained the other 13 items. This resulted in a two-factor model with RMSEA ($=0.057$; Satorra-Bentler $= 0.037$) implying an adequate fit to the data (CFI $= 0.947$, TLI $= 0.932$; Satorra-Bentler CFI $= 0.972$ TLI $= 0.965$).

Retained items in factor 1 reflected a woman's experiences of childcare stress, job loss, relationship stress, health provider stress and stress derived from other family members. We define this factor as general pregnancy stress. Retained items in factor 2 reflect stress specifically associated with strained partner dynamics.

Discussion

In this study, we used a basic exploratory sequential mixed method design¹¹ to develop and validate the *Healthy Pregnancy Stress Scale* (HPSS). Semi-structured free-listing interviews were conducted to determine items to include in the scale. Exploratory factor analysis with one random split-half sample identified a two-factor structure to the items included (Factor 1: *General pregnancy stress*, Factor 2: *Relationship strain*). Confirmatory factor analysis in the second random split-half sample validated this structure in a population of low-income African American women.

There is a dense body of literature on biological data linking pregnancy stress pathways with birth, early developmental health, and maternal health and well-being^{3,29}. Yet, psychosocial stress measures have been less consistent in their association with birth, antenatal, and postpartum outcomes⁸. Much of this inconsistency is likely due to inconsistent measurement type and quality. For example, the *Prenatal Psychosocial Stress Profile* has been used to quantitatively capture pregnancy stress among low-income women³⁰. Designed based on the author's clinical experiences with low-income women, this scale focused on self-esteem, stress, and social support³⁰. Validation studies in a diverse population of women demonstrated validity of the scale but the content and structure of the inventory may not be

adequately capturing key stress exposures. The items in this scale were derived based on *a priori* assumptions about the relevance of pregnancy stressors and component dimensions from the clinician's perspective³¹. This approach presupposes universal applicability of the items without considering a more inductive approach to the study population. Scales developed in such a way may miss the subjective experiences of health and stress and thus may not capture stressors that are most salient to the women being studied.

Another challenge with scale measurement is that the items are vague and conflate the domains of stress being measured. One item is *financial worries like food, shelter, healthcare, transportation* and the next item asks about *other money worries*. Shelter concerns imply the potential for instability which emerged in our scale as an important item: *My home life is unstable or unpredictable*. Financial concerns leading to shelter instability are distinctly associated with health and child well-being³². In this study, transportation concerns did not emerge as one of the more salient stressors. While they may both be associated with financial concerns, a more granular understanding is useful. While the *Prenatal Psychosocial Stress Profile* measure has been helpful in highlighting the importance of prenatal stress and demonstrated the relationship between pregnancy stress and health, it is not functionally useful in identifying specific domains of concern that could inform intervention development.

Another type of scale that has been used in the pregnancy stress literature targeting African American women is the Jackson Hogue Phillips Stress Scale (JHP)¹⁴. This measure was designed to capture racial and gender discrimination, and has been used to understand the association between these types of discrimination and pregnancy health. Understanding these relationships is important and, similar to our scale, partner relationships were found to contribute substantially to the women's self-identified stress^{14,24,33}. The JHP has been correlated with depression among well-educated pregnant African American women, regardless of life-course socioeconomic status as well¹³. This scale has contributed to our understanding of race, gender and health; however, it runs into similar challenges as the *Prenatal Psychosocial Stress Profile* in item specificity. It was also created specifically targeting well-educated African American women. Thus, many domains over-emphasize areas that may be less relevant to low-income women and omit areas that may be of significant relevance. Finally, it was not created specifically for pregnancy stress but to measure life stressors described by gendered discrimination that might be contributing to pregnancy experiences and outcomes.

The HPSS scale provides a unique, internally validated tool that has the potential to address some gaps in understanding of stress pathways and pregnancy health by quantifying qualitatively derived environmental exposures. It has the flexibility to be used across socioeconomically and racially diverse populations because it was designed to include stressor domains across these diverse groups. In this study, the HPSS has been validated in a population of women consistently understudied but most affected by disparities in reproductive health. While factors such as life course discrimination and racism affect a woman's stress load, structural inequities exist that can affect the number and types of stressors a woman is exposed to. This is an important distinction because perceptions of racial discrimination are difficult to define and require more complex societal interventions

that go far beyond the reach of many pregnancy health clinics. What is more tangible for intervention are the immediate experiences within a woman's life that directly and currently impact her pregnancy.

Limitations in this study include the need for a larger sample of women to test the external validity of this measure. We did not measure depression in the women included in our study. We also did not assess criterion validity of HPSS by comparing it with the JHP. This would have provided further validation of this measure. Like the JHP, the HPSS was developed using grounded theory. One of the challenges of this approach is capturing qualitative themes for quantitative measurement while keeping fidelity in meaning. Future development of this inventory should include further contextualization in the meaning of these responses, so that we can better inform intervention and care. The strengths of this study are that this scale provides a screening tool that could be used to identify intervention targets such as service referral. It also provides a scale that, if further validated across different socioeconomic and racial populations, could provide a flexible way to determine differences in pregnancy stress experiences across diverse populations of women. Understanding differences in stressor exposure over the course of pregnancy supports better understanding of racial, class and other outcome disparities.

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Appendix A. Healthy Pregnancy Stress Scale

This scale is designed to assess pregnancy stressors women have experienced during their pregnancy.

Interviewer Introduction

In this questionnaire, I will ask you a set of questions for me to understand types of stress you experienced during your last pregnancy. We would really like to know what you think. This information helps us better understand how your pregnancy needs are being met. Please be as honest about your experience as you can.

Scoring

HPSS contains 18 items. Response options for each item form the following Likert scale: 1= “*Not a source of stress during pregnancy at all*” to 6 = “*Source of great stress during pregnancy.*” All items are scored in the same direction. Interviewers have the option of recording responses to the “Please explain” question for further qualitative assessment and contextualization.

1. I had difficulty finding help with other children when I needed it during pregnancy. Please explain.					
1	2	3	4	5	6
2. I lost my job or was unable to find a job by me or my partner while pregnant. Please explain.					
1	2	3	4	5	6
3. I had difficulty meeting work obligations and managing my responsibilities at home while pregnant. Please explain.					
1	2	3	4	5	6
4. The worry about the health of my baby became a source of stress during pregnancy. Please explain.					
1	2	3	4	5	6
5. My own health concerns during pregnancy became a source of stress. Please explain.					
1	2	3	4	5	6
6. I had a strained or stressed relationship with partner while pregnant. Please explain.					
1	2	3	4	5	6
7. I had to balance my personal pregnancy needs with life obligations during my pregnancy. Please explain.					
1	2	3	4	5	6
8. I made the decision to leave a profession or job while pregnant. Please explain.					
1	2	3	4	5	6
9. My partner was not available during pregnancy because he worked too much. Please explain.					
1	2	3	4	5	6
10. During pregnancy I worried about the situation of childcare I would have after my baby is born. Please explain.					
1	2	3	4	5	6
11. During pregnancy I had a fear of having another or a new child in the home. Please explain.					
1	2	3	4	5	6
12. During pregnancy my home life was unstable or unpredictable. Please explain.					
1	2	3	4	5	6

13. During pregnancy my partner was absent due to military service. Please explain.

1	2	3	4	5	6
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14. During pregnancy I did not want to be pregnant. Please explain.

1	2	3	4	5	6
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15. During pregnancy I was treated poorly by my health care providers. Please explain.

1	2	3	4	5	6
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16. It was stressful having other family members staying with me while I was pregnant. Please explain.

1	2	3	4	5	6
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17. My partner was not supportive and available to me during pregnancy. Please explain.

1	2	3	4	5	6
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18. While pregnant, the father of the child would not accept the responsibility of being a father. Please explain.

1	2	3	4	5	6
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Significance

What is already known on this subject?

Stress during pregnancy negatively affects maternal and child health. Current inventories of pregnancy stress are not specific and not validated in a variety of populations.

What this study adds?

The HPSS offers a pregnancy-specific stress scale validated in a population of low-income African American women, but designed for use in diverse populations. This is important for understanding the relationship between structural inequities, pregnancy stress and pregnancy health. This internally validated tool has the potential to function as a quick assessment of the pregnancy environment.

Table 1

Characteristics of the Sample, Overall African American WIC Clients, in Atlanta Georgia, N=178

Characteristics	Total Sample	
	Mean	%
Age, in years, mean (sd:5.89)	28.0	
Number of children, mean (sd:1.29)	2.03	
Relationship status (%)		
Single		42.7
In a relationship		57.0
Unmarried relationship		46.2
Married		10.8
Highest level of education (%)		
Less than high school		17.7
High School		63.9
Some College or higher		18.4

Table 2
Item correlation, means and standard deviations for the Health Pregnancy Stress Scale, N=178

Items*	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P14	P15	P16	P17	P18
P1: Difficulty finding help other with children	1.000																
P2: Job loss	0.10	1.00															
P3: Difficulty balancing work and home obligations	0.23*	0.43*	1.00														
P4: Worry over the health of my baby	0.11	0.11	0.22*	1.00													
P5: Worry over my own health	0.29*	0.15	0.21*	0.42*	1.00												
P6: Strained partner relationship	0.23*	0.30*	0.23*	0.22*	0.18*	1.00											
P7: Difficulty balancing personal and pregnancy needs	0.33*	0.32*	0.37*	0.28*	0.27*	0.34*	1.00										
P8: Left a job or profession	0.18*	0.14	0.22*	0.05	0.13	0.15	0.21*	1.00									
P9: Partner not available due to overworking	0.15*	0.16*	0.09	-0.02	0.25*	0.27*	0.17*	0.12	1.00								
P10: Worry over situation of childcare after the birth	0.16*	0.06	0.25*	0.22*	0.25*	0.10	0.23*	0.10	0.07	1.00							
P11: Fear of another child in the home	0.34*	0.14	0.19*	0.24*	0.31*	0.22*	0.20	0.10	-0.02	0.26*	1.00						
P12: Unstable/unpredictable home life	0.40*	0.27*	0.32*	0.23*	0.22*	0.37*	0.45*	0.28*	0.11	0.09	0.29	1.00					
P14: Didn't want to be pregnant	0.09	0.16*	0.12	0.09	0.03	0.26*	0.13	0.12	-0.02	0.28*	0.26*	0.14	1.00				
P15: I was treated poorly by my health care provider	0.10	0.18*	0.11	0.16*	0.07	0.09	0.23*	0.05	0.12	0.00	-0.05	0.02	-0.08	1.00			
P16: Stressful having other family members staying with me	0.20*	0.15*	0.09	0.12	0.13	0.22*	0.26*	0.13	0.16*	0.14	0.15*	0.25*	0.11	0.22*	1.00		
P17: Partner not supportive and available to me	0.22*	0.30*	0.35*	0.13	0.17*	0.70*	0.32*	0.16*	0.29*	0.18*	0.22*	0.33*	0.21*	0.08	0.20*		
P18: Father of child not accepting responsibility as father	0.13	0.23*	0.30*	0.17*	0.13	0.50*	0.25*	0.08	0.08	0.07	0.20*	0.29*	0.24*	0.07	0.10	0.68*	1.00
Mean	1.25	2.52	2.17	2.61	2.49	2.83	2.20	1.65	1.69	2.54	2	1.83	2.15	1.21	1.78	2.31	2.01
Median (SD)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Min/Max	1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/6	1/6

* p-value < 0.05

Table 3

Healthy Pregnancy Stress Scale Factor Loadings, N=178

<i>Factor 1</i>	Items	EFA Loading (N=85)	CFA Loading (N=88)	TLI	CFI	RMSEA	Chi ² (df)	p-values
	P1	0.424	0.474					
	P2	0.347	0.446					
	P3	0.495	0.573					
	P4	0.508	0.495					
	P5	0.571	0.409					
	P7	0.724	0.552					
	P8	0.330	0.350					
	P10	0.463	0.174					
	P11	0.319	0.439					
	P12	0.573	0.787					
<i>Factor 2</i>								
	P6	0.613	0.825					
	P17	0.856	0.937					
	P18	0.700	0.755					
Model Fit								
Unadjusted				0.932	0.947	0.057	68.4 (61)	0.241
Satorra-Bentler				0.965	0.972	0.037	-----	-----