The Balance Between Stress and Personal Capital during Pregnancy and the Relationship with Adverse Obstetric Outcomes: Findings from the 2007 Los Angeles Mommy and Baby (LAMB) Study

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Abstract

Purpose—Stress during pregnancy is a salient risk factor for adverse obstetric outcomes. Personal capital during pregnancy, defined as internal and social resources that help women cope with or decrease their exposure to stress, may reduce the risk of poor obstetric outcomes.

Methods—Using data from the 2007 Los Angeles Mommy and Baby (LAMB) survey (N=3,353), we examined the relationships between the balance of stress and personal capital during pregnancy, or the Stress-to-Capital Ratio (SCR), and adverse obstetric outcomes ((i.e., pregnancy complications, preterm birth (PTB), low birthweight (LBW), and small-for-gestational-age (SGA)).

Results—Women with a higher SCR (i.e. greater stress relative to personal capital during pregnancy) were significantly more likely to experience at least one pregnancy complication, PTB, and lower gestational age, but not LBW or SGA. Accounting for pregnancy complications completely mediated the association between the SCR and PTB.

Conclusions—Our findings indicate that experiencing greater stress relative to personal capital during pregnancy is associated with an increased risk for pregnancy complications, PTB, and lower gestational age and that pregnancy complications may be a mechanism by which the SCR is related to adverse obstetric outcomes.

Keywords

Personal capital; maternal stress; obstetric outcomes; preterm birth; pregnancy complications

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Introduction

In the United States, adverse obstetric outcomes, including pregnancy complications, preterm birth (PTB), low birthweight (LBW), and small-for-gestational-age (SGA), account for over 40 percent of all neonatal deaths (Heron 2012) and have contributed to significant increases in childhood morbidity in recent decades (Hack et al. 1995; Kramer 2003; McCormick 1985). Mounting evidence suggests that stress during pregnancy is a salient risk factor for poor obstetric outcomes (Dole et al. 2003; Rondo et al. 2003). However, studies have largely employed uni-dimensional stress measures, such as perceived stress or stressful life events (Sable & Wilkinson 2000; Zhu et al. 1999). Furthermore, very few studies have examined the components of personal capital during pregnancy, or the resources that may help women cope with or decrease their exposure to stress during pregnancy (Wakeel et al. 2013), and none have explored personal capital as a composite construct that is related to obstetric outcomes. Importantly, no study has examined the relationship between stress, personal capital and obstetric outcomes. Therefore, we created and employed a conceptually-based ratio of stress and personal capital, or the Stress-to-Capital Ratio (SCR), to determine if and how the balance between these two factors during pregnancy was associated with obstetric outcomes.

Theory suggests that stress is a process by which environmental stimuli (e.g. stressful life events) may overwhelm an individual's coping resources (Cohen & Williamson 1987), leading to the perception of stress and subsequent physiological responses that attempt to gain homeostasis (McEwen 1998). Physiological responses to stress that have been shown to directly impact obstetric outcomes primarily entail the neuroendocrine and immune/ inflammatory processes (Coussons-Read et al. 2005, 2007; Dunkel-Schetter 2011; Gennaro & Hennessy 2003; Steer 2005; Wadhwa et al 1998, 2001, 2004). Additionally, the two pathways most likely interact with each other in that the combination of chronic stress and infectious pathogens has an additive impact, resulting in shortened gestational length (Wadhwa et al. 2001).

Personal capital is a multidimensional set of resources that may help women cope with or reduce their exposure to stress during pregnancy (Wakeel et al. 2013), yet as defined, it has been under-explored in the literature and has not been tied to obstetric outcomes. We posit that personal capital may operate on multiple levels (Bronfenbrenner 1977, 1979) to increase the likelihood of favorable obstetric outcomes. At the individual level, internal resources (i.e., self-esteem and mastery) have been associated with higher infant birthweight (Rini et al. 1999) and decreased risk of intrauterine growth retardation (IUGR) (Goldenberg et al. 1991). At the interpersonal level, social resources, including partner support and social network support, have been linked to increased fetal growth, better labor progress, higher birthweight, and higher infant APGAR scores (Collins et al. 1993; Feldman et al. 2000). At the community level, neighborhood support may play an indirect role in lowering women's risk of adverse obstetric outcomes (Bell et al. 2006). As previous studies have provided evidence of the independent effects of personal capital components on obstetric outcomes, we expand this work by incorporating these critical resources into a unified construct to comprehensively capture the available resources that women may garner during pregnancy.

Although stress and components of personal capital have been shown to be associated with obstetric outcomes, there is a paucity of research examining the relationships among stress, personal capital, and outcomes. To our knowledge, our study is the first to examine the balance of stress and personal capital during pregnancy in relation to subsequent obstetric outcomes. Our research draws upon Misra et al.'s (2003) framework of perinatal health, which integrates the life-course model (Halfon & Hochstein 2002) with the multiple determinants of health theory (Evans & Stoddard 1990), as well as stress theory (House

1974). The life-course model posits that perinatal health is influenced by cumulative effects of events across the lifespan as well as intergenerational effects, while the multiple determinants of heath theory proposes that a combination of interrelated biological, psychological, behavioral, social and environmental factors contributes to health outcomes. Additionally, stress theory (Lazarus & Folkman 1984) contends that both maternal risks (e.g. stress) and resources (e.g. personal capital) likely influence obstetric outcomes and that greater risks relative to resources may lead to deleterious obstetric outcomes. Overall, we posit that stress and personal capital likely accumulate over the life-course from multiple sources and modify each other in impacting obstetric outcomes. Consequently, we operationalized the relationship between stress and personal capital as a ratio that captures the continuum of the relative levels of these two factors during pregnancy, rather than examining the interaction between stress and personal capital, which ignores stress *relative* to personal capital and instead only captures concurrent increases or decreases in these two constructs. Therefore, the aims of this paper were to: 1) create a Stress-to-Capital Ratio (SCR) which empirically represents the level of balance between stress and personal capital during pregnancy; and 2) examine the relationships between the SCR and the risk of adverse obstetric outcomes, specifically pregnancy complications, PTB, LBW, and SGA.

Materials and Methods

Sample

Data are from 3,353 women who participated in the 2007 LAMB study, a cross-sectional, population-based study that examined preconception, prenatal, and postpartum correlates of adverse MCH outcomes. Eligible mothers were Los Angeles County residents who had given birth to a live-born infant in Los Angeles County in 2007.

The 2007 LAMB Study was a collaboration between the University of California, Los Angeles (UCLA) and the Los Angeles County Department of Maternal, Child and Adolescent Health. They employed a stratified random sample, selected by sampling neighborhoods based on census tracts and then sampling births within the neighborhoods, resulting in a sample of 4,518 women. The response rate for the Los Angeles County sample was 56%, after adjusting for faulty addresses, language issues, maternal deaths, and loss to follow-up due to inability to locate the respondent.

Respondents with missing values for personal capital (n=762), stress (n=467), and prenatal depressive symptoms (n=113) variables were removed by listwise deletion, resulting in a sample size of 3,411 women. Furthermore, as 99 of these mothers had gestational age data that was either missing (n=90) or deemed illogical (n=9) (i.e., values <100 days or >365 days), we imputed for this variable based on estimated dates of conception and infant birth data. We used only estimated gestational age values that were logical (100–365 days), resulting in a final sample size of 3,353 women for the present analyses.

We compared the sociodemographic characteristics and obstetric outcomes of women with missing data (n=985) and women with complete data (n=3,353). Women with missing data were significantly more likely to be Hispanic, unmarried, low-income, less educated; there were no significant differences in obstetric outcomes among the two groups.

Procedures

In 2007, over 10,000 surveys were mailed to eligible women within six months after delivery. The recruitment process entailed a(n): 1) mailed preletter four months after childbirth; 2) initial mailed questionnaire one week later; 3) mailed reminder one week later; 4) second mailed questionnaire two weeks later (if needed); and 4) telephone follow-up two

weeks later (if needed). Finally, the data from the completed surveys were linked to corresponding California birth certificates prior to analyses.

The survey was approved in 2007 by both the Los Angeles County Department of Public Health and UCLA Institutional Review Boards and therefore has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Measures

Outcome variables—Poor obstetric outcomes included pregnancy complications, PTB, LBW, and SGA. Pregnancy complications, which included pregnancy-induced hypertension, gestational diabetes, premature labor (i.e., labor that began <37 weeks gestation), premature rupture of membranes (i.e., membrane rupture occurring <37 weeks gestation), bacterial vaginosis, and kidney or bladder infection during pregnancy, were dichotomized as either experiencing any versus no complication. Three gestational age categories were used, including PTB (i.e., delivery occurring before 259 days of gestation), early-term birth (i.e., delivery occurring between 259 and 272 days), and late-term birth (i.e., delivery occurring at or after 273 days). Preterm and early-term births were compared with late-term births. Infants weighing less than 2,500 grams at birth were considered to be LBW and were compared with normal-weight infants (i.e., weighing 2,500–4,000 grams). Using Olsen et al.'s (2010) gender-specific growth curves, we defined SGA infants as those weighing less than 10% of the birthweight of infants of their gender and gestational age and compared them with appropriate-for-age infants (i.e., weighing above the 10th percentile for their age and gender). Infant birthweight, gestational age, and gender were obtained from birth records; pregnancy complications were self-reported in the LAMB survey.

Stress and personal capital measures—Stress was operationalized as perceived stress and severe stressful life events during pregnancy (Appendix A). Perceived stress items (e.g. feeling sad) assessed psychological stress during pregnancy and inquired about the degree to which the respondent appraised her life as stressful (Cohen et al. 1983). Severe stressful life events measured environmental stress and included events (e.g. death of a loved one) that have been shown to impact obstetric outcomes (Newton and Hunt 1984).

Personal capital was operationalized as internal resources, partner support, social network support and neighborhood support during pregnancy (Appendix A). Internal resources included self-esteem and mastery. Self-esteem (e.g. overall satisfaction with self) was defined as a "positive or negative orientation toward oneself or an overall evaluation of one's worth or value." (Jesse et al. 2006: 70). Mastery (e.g. being able to do anything she sets her mind to do) embodied the belief that one has control over her life (Rini et al. 1999). Partner support encompassed instrumental (e.g. financial support) and emotional support from the baby's father (Fragile Families Study 2003). Social network support included support (e.g. having someone help with childcare) from kin and close friends (Adams et al. 1991). The neighborhood support items concerned neighborhood social cohesion (e.g. being a close-knit neighborhood) and reciprocal exchange (e.g. neighbors visiting each other's homes) (Buka et al. 2003).

Stress-to-Capital Ratio (SCR)—The relationship between stress and personal capital was operationalized as a ratio in order to capture the continuum of women's relative levels of stress and personal capital. Testing the interaction between stress and personal capital was not performed as an interaction term ignores stress *relative* to personal capital and instead only captures concurrent increases or decreases in these two constructs. Therefore, we argue that an interaction between these constructs is neither practically relevant nor a sufficient

answer to our research question; as such, only the method of the SCR was employed in this study.

Prior to the creation of the SCR, items within the stress and personal capital measures were summed to create raw overall scores for each measure, with higher scores reflecting greater levels of that measure. Based on theory (Figure 1), weighting schemes were applied to the variables that contributed to the composite measures of stress and personal capital. For the composite stress measure, perceived stress was weighted twice as heavily (67%) as severe life events (33%) because while life events may not render the same impact on all individuals, the subjective appraisal of stress arguably has a more direct effect on mental health during pregnancy as well as the behavioral and biological pathways leading to adverse obstetric outcomes (Ayers 2001; Dole et al. 2003; Hedegaard et al. 1996; Lazarus & Folkman 1984, Lobel et al. 1992). Additionally, severe life events are rare shocks, whereas perceived stress is likely to be persistent and chronic (Lobel & Dunkel-Schetter 1990). Furthermore, for the composite personal capital measure, proximal (i.e., internal) resources were weighed more heavily than distal (i.e., social) resources, as they were posited to have a more direct impact on the individual (Cohen & Wills 1985; Hobfoll et al. 1987; Hobfoll 2002). As such, internal resources, partner support, social network support, and neighborhood support comprised 32.5%, 27.5%, 22.5%, and 17.5%, respectively, of the overall personal capital score. The weighted composite measures for stress and personal capital were constructed such that the scores ranged from 1 to 100.

Two sensitivity analyses were performed to examine the assumptions used in the weighting schemes for personal capital and stress. First, twenty weighting schemes (based on five schemes for stress and four schemes for personal capital) were empirically tested by evaluating the predictive ability of each scheme for the outcomes under investigation. This analysis showed that the results did not substantially vary across these weighting schemes. Second, we conducted confirmatory factor analysis (CFA) using Mplus 7 (Muthen and Muthen, Los Angeles, CA). The standardized factor loadings from our CFA, which included personal capital and stress as two latent factors with their respective components, confirmed our chosen weighting schemes for personal capital and stress (data available upon request). Based on the results from these analyses, the weighting scheme with the best predictive ability was chosen as the final scheme.

In order to create the SCR, the finalized weighted composite measures of stress and personal capital were standardized. First, various cumulative distribution functions for the stress and personal capital measures were examined for the best possible fit. The weighted composite score for stress followed a Gamma distribution, and the weighted composite score for personal capital followed a Beta distribution. The probability of each weighted score was calculated based on the appropriate distribution, and this probability was applied to a Normal/Gaussian distribution (mean of 50, standard deviation of 10) to determine the standardized score. The standardized stress score was then divided by the standardized personal capital score to derive the raw SCR. Finally, the raw SCR was natural log transformed in order to ensure a symmetric distribution for the final SCR (Figure 2). *An SCR greater than zero indicated greater stress relative to personal capital during pregnancy*.

Control variables—The multivariate analyses controlled for maternal race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, Asian/Pacific Islander, Native American), age (continuous), education (12 versus <12 years of schooling), annual household income ($19,000, $20,000-$39,000, $40,000-$59,000, $60,000-$99,000, $100,000), marital status (married, single/never married, separated/divorced/widowed, cohabiting), prenatal depressive symptoms (yes versus no), the number of prior children 5 years old (continuous), parity (primaparous versus multiparous), and pre-pregnancy health conditions

(i.e., hypertension and diabetes) (yes versus no) and depression (yes versus no). Further, to capture contextual neighborhood effects, we adjusted for geographic region of residence within Los Angeles County, or service planning area (SPA; Antelope Valley, San Fernando Valley, San Gabriel Valley, Metro Los Angeles, West, South, East, and South Bay). Data for race/ethnicity, age, education, and SPA were obtained from birth certificates, whereas data for the other control variables were self-reported in the survey.

Analytic Approach

Analyses were conducted using SAS 9.3 (SAS Institute Inc, Cary, NC) and were weighted to account for sampling design and survey non-response. First, in order to determine the levels of stress and personal capital within the sample, the means of the raw, weighted, and standardized scores for each stress and personal capital measure as well as the raw and log-transformed final SCR's were calculated; reliability statistics (i.e., Cronbach's alphas) were also computed for the overall measures and components of stress and personal capital. Second, bivariate comparisons were made between sociodemographic, health, and obstetric characteristics and the SCR; Table 1 shows comparisons of the mean SCR by the independent and dependent variables, while Tables 3 and 4 include comparisons of the mean SCR and covariates by obstetric outcomes. Third, multivariable logistic regression models were developed to examine the relationships between the SCR and pregnancy complications, LBW, and SGA. Multinomial logistic regression models were employed to investigate the relationship between the SCR and the gestational age categories (i.e., PTB versus late-term birth; early-term birth versus late-term birth). Additionally, Sobel tests (Baron & Kenny 1986) were performed to test for the potential mediating role of pregnancy complications in the associations between the SCR and PTB, LBW, and SGA. Finally, we conducted multivariable linear regression to examine the relationships between the SCR and gestational age and birthweight as continuous outcomes.

Results

Descriptive Comparison of Maternal Characteristics by Stress-to-Capital Ratio (SCR) Scores

The majority of respondents were 19–34 years old, Hispanic, multiparous, or had incomes $39,000 or 12 years of schooling (Table 1). Over half of the women were married or had no prior children 5 years old. Approximately 15% of women reported pre-pregnancy depression, 20% of women reported prenatal depressive symptoms, and 5% of women reported having a pre-pregnancy health condition. Additionally, 44%, 13%, 8%, and 11% of women experienced pregnancy complications, PTB, LBW, and SGA, respectively.

Overall, respondents who were 18 years old, non-White, unmarried, or low-income had, on average, higher SCR (i.e. greater stress relative to personal capital) scores (Table 1). Women who lived in SPA 1 had at least two prior children 5 years old, had lower education or had experienced pre-pregnancy health conditions or depression, prenatal depressive symptoms, pregnancy complications or PTB also had higher SCR scores.

Distribution of Stress, Personal Capital, and Stress-to-Capital Ratio (SCR) Scores

Overall, the composite stress and personal capital measures and the stressful life events measure had low reliability, whereas all of the personal capital components and the perceived stress measure had high reliability (Cronbach's alphas 0.80) (Table 2). Respondents, on average, had relatively low weighted stress scores (mean=24) and high weighted personal capital scores (mean=72) (Table 2). The final SCR ranged from −2.1 to 1.6, with a mean of −0.09 (Figure 2, Table 2).

Pregnancy Complications

Women who experienced at least one pregnancy complication had significantly higher mean SCR scores than women who did not experience any complications (Table 3). Black, single/never married women, as well as women with unknown educational attainment, prenatal depressive symptoms, or pre-pregnancy health conditions or depression were also significantly more likely to report at least one pregnancy complication (Table 3)

Multivariate analysis indicated that women with higher SCR's were significantly more likely to experience at least one pregnancy complication (OR= 1.35; p=0.004) (Table 3). Additionally, a higher SCR was most significantly associated with hypertension (OR=1.54; p=0.03), diabetes (OR=1.45; p=0.02), and premature labor (OR=1.36; p=0.03) during pregnancy.

Preterm Birth and Gestational Age

Bivariate comparisons indicated that women who experienced PTB had significantly higher mean SCR scores than women who experienced a late-term birth (Table 4). Also, women who were Hispanic, multiparous, had low or unknown income, cohabited with their partners, or experienced prenatal depressive symptoms or pre-pregnancy health conditions or depression were more likely to experience PTB (Table 4). Notably, among women who experienced PTB, 70% of them also reported at least one pregnancy complication. Furthermore, women who were older, multiparous, or experienced at least one pregnancy complication were more likely to have an early-term birth, as opposed to a late-term birth (Table 4).

Further, the SCR was significantly associated with PTB (OR=1.36; p=0.03), but not early-term birth, in the multivariate analysis (Table 4 Model 1). Accounting for pregnancy complications completely mediated this association for PTB (Table 4 Model 2). Sobel test findings further confirmed that pregnancy complications mediated the association between the SCR and PTB (Z-value=−5.82, p<0.001). We then conducted supplementary logistic regression analyses to individually account for each pregnancy complication and found that premature labor appeared to be the largest contributor to the mediating effect of pregnancy complications on the risk of PTB (data not shown). Furthermore, using multivariable linear regression to examine the association between the SCR and gestational age, we found that a one unit increase in the SCR was associated with a decrease of 1.8 gestational days, even after accounting for pregnancy complications (Table 5 Model 2).

Infant Birthweight and Small for Gestational Age

Overall, the mean SCR scores did not significantly differ by LBW or SGA statuses (data available upon request). Further, there were no significant associations between the SCR and LBW, SGA, or continuous infant birthweight, even in the unadjusted models (data available upon request).

Supplementary Analyses of Relationships between the Individual Personal Capital and Stress Measures and Obstetric Outcomes

In order to compare the individual associations between the SCR, standardized personal capital and standardized stress measures with obstetric outcomes, multivariable logistic regression analyses were conducted. In the final models, none of the personal capital or stress components or composite scores were *independently* associated with adverse obstetric outcomes (data available upon request).

Discussion

Our study contributes to the literature in three important ways. First, our findings provide evidence that experiencing greater stress relative to personal capital during pregnancy is significantly associated with the risk of pregnancy complications, PTB, and lower gestational age; further, pregnancy complications completely mediate the relationship between the SCR and PTB. Second, most studies have explored individual dimensions of stress and personal capital, whereas we developed conceptually-based, multi-dimensional stress and personal capital measures. This contribution is particularly significant in terms of personal capital as it has been previously under-explored. Third, to our knowledge, our study is the first to examine the balance between stress and personal capital during pregnancy and its relationship with adverse outcomes, as previous work has only considered the independent effects of stress and individual components of personal capital. Expanding the theoretical approach to incorporate both risks and resources during pregnancy is imperative because these factors do not exist independently of one another; rather, they coexist to determine women's resiliency (i.e., the ability to bounce back after facing adversity due to having adequate personal capital relative to stress) and ultimately impact their risk of adverse obstetric outcomes.

Our finding regarding the significant association between the SCR and pregnancy complications is important, as there is a dearth in the literature on the relationships between stress, personal capital, and pregnancy complications. A prospective study by Roy-Matton et al. (2011), which operationalized pregnancy complications similar to our study, revealed that women who had higher perceived stress at 10–20 weeks of pregnancy were more likely than their counterparts to experience subsequent pregnancy complications. Our findings expand on this research by supporting the theoretically justified link between higher stress and lower personal capital taxing the female body to the extent that pregnancy complications may result. Although we cannot definitively establish that the pregnancy complications occurred after experiencing a high SCR, the proposed mechanism is biologically plausible. As this association has important implications for reducing the risk of pregnancy complications, future prospective work should focus on this pathway.

We also found that experiencing pregnancy complications, especially premature labor, mediated the risk of PTB for women with higher SCR's. This finding is unsurprising, as spontaneous premature labor is a primary symptom of PTB (Steer 2005). This finding is also important, as it indicates that targeting efforts to decrease women's risk of pregnancy complications, especially premature labor, may help prevent PTB. Additionally, our finding regarding the significant negative linear relationship between the SCR and gestational age, even after accounting for pregnancy complications, underscores the critical role that the SCR plays in determining infant gestational age, which may not be best captured by the use of cut-points (i.e., PTB vs. not PTB). Each day in the womb has critical long-term medical and social implications for child health (Moster et al 2008), and if higher stress relative to personal capital can decrease gestation by several days, then reducing women's stress and increasing their resources will play an important role in improving birth outcomes and subsequent child health.

Furthermore, we found that the SCR was not significantly associated with LBW, continuous birthweight, or SGA in our study. Theory and empirical evidence suggest that the biological pathways to LBW and SGA can differ from the pathways to PTB (Coussons-Read et al. 2005, 2007; Dunkel-Schetter 2011; Gennaro & Hennessy 2003; Steer 2005; Wadhwa et al. 1998, 2001, 2004). The mechanisms contributing to LBW and/or SGA may involve more prolonged exposures or exposures that occur further upstream, such as the preconception

period (Precht et al. 2007); therefore, future research should investigate the SCR both during and before pregnancy in relation to infant growth and birthweight.

Our findings have important implications for clinical and public health interventions to reduce women's risk for experiencing adverse obstetric outcomes. In clinical settings, routinely assessing the life stressors, psychological stress, and available internal and social resources among women who are pregnant or planning pregnancy would enable healthcare providers to offer the most appropriate support (e.g. referrals to community resources) to women with high levels of stress or low personal capital. Moreover, though life stressors may be unavoidable, there are multiple public health opportunities at the individual, interpersonal, and community levels to increase personal capital and potentially counteract perceived stress for pregnant and preconception women. We posit that programs that offer comprehensive resources (e.g. individual, group, and couples counseling, individual and group prenatal care) would be more likely to increase personal capital relative to stress, and subsequently, resiliency, among pregnant women.

Several potential limitations should be considered when interpreting the findings of this study. First, as the survey was administered postpartum, and many of the variables in this study were self-reported, responses may be vulnerable to bias. Second, women with missing data for the stress, personal capital, and prenatal depressive symptoms variables were removed from the analyses; nonetheless, as these women were likely to have the lowest personal capital and highest stress, our findings were likely conservative estimates of the examined associations. Third, the weighting schemes for the stress and personal capital measures, though conceptually based, may not have accurately captured the relative importance of the individual components and may not be applicable to all populations. However, our sensitivity analysis found very similar associations among the different SCRs and obstetric outcomes. Fourth, the measurement of stress and personal capital was limited to the available variables in the LAMB survey; therefore, we were unable to incorporate pregnancy-specific measures of stress or other potential components of personal capital (e.g. spirituality).

The LAMB study had some potential limitations as well. Its cross-sectional nature precluded the assumption of causality between predictors and outcomes. Also, it had a relatively low response rate, though we argue that non-respondents were at higher risk for having low personal capital and greater stress and that our findings were thus conservative estimates of the associations examined. Finally, though the study sample was diverse and representative of the LA population, the findings may not be generalizable to other populations.

Based on the findings and potential limitations, this study highlights the need for further areas of research. First, future studies need to assess the reliability and validity of the SCR in relation to obstetric outcomes to test the generalizability of our measure and our findings in other populations. Second, in order to inform effective clinical and public health interventions, further longitudinal research is warranted to examine the potential causal mechanisms in which the SCR may be associated with pregnancy complications. Third, we recommend that longitudinal studies incorporate life-course measures of stress (e.g. early childhood trauma, pregnancy-specific stress) and personal capital (e.g. childhood family stability) in order to identify effective points of intervention throughout the life-course and ultimately improve maternal and child health outcomes.

Conclusion

Our study examined the relationship between the balance of personal capital and stress during pregnancy, operationalized as the SCR, and adverse obstetric outcomes, including

pregnancy complications, PTB, LBW, and SGA. Our findings indicate that women's relative level of personal capital and stress during pregnancy is significantly associated with the risk of experiencing at least one pregnancy complication, PTB, and lower gestational age; further, pregnancy complications mediated the associated between the SCR and PTB, thereby suggesting that pregnancy complications may be a mechanism linking the SCR to adverse obstetric outcomes. Most importantly, our work underscores the importance of recognizing that risks and resources coexist in women's lives and likely impact each other; therefore, we need to address both women's stress *and* personal capital during pregnancy in order to improve obstetric outcomes and long-term maternal and child health outcomes.

Acknowledgments

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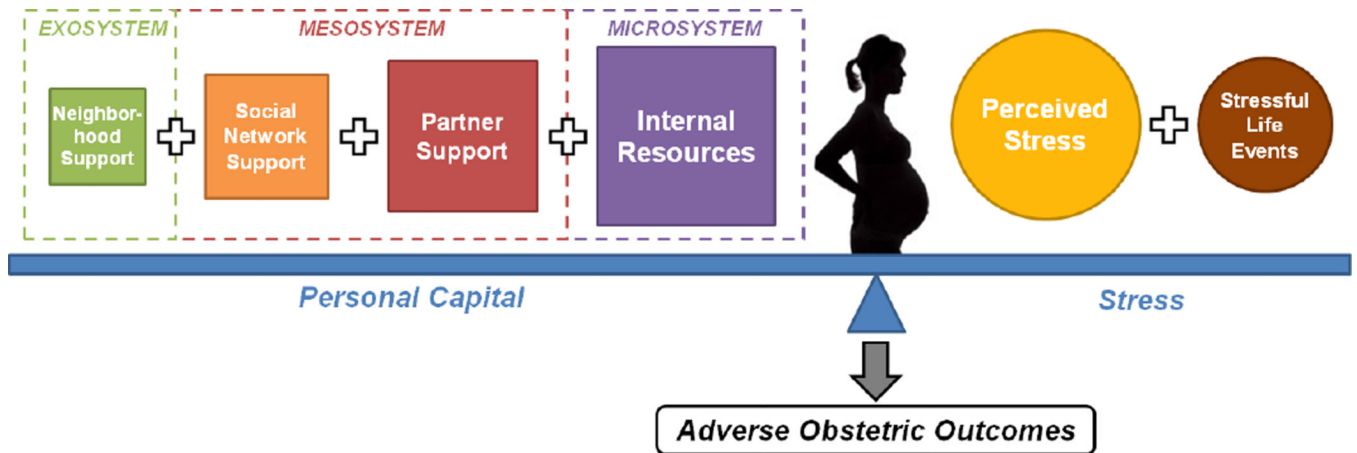
Figure 1. A Conceptual Framework for the Relationship between the Balance of Personal Capital and Stress during Pregnancy and Adverse Obstetric Outcomes
The figure illustrates the balance between personal capital and stress during pregnancy. The personal capital score was created using a weighting scheme based on Bronfenbrenner's ecological model and comprised internal resources, partner support, social network support, and neighborhood support. Proximal resources were weighed more heavily than distal resources as they were posited to have a larger and more direct impact on the individual. As such, internal resources, partner support, social network support, and neighborhood support comprised 32.5%, 27.5%, 22.5%, and 17.5%, respectively, of the overall score. Further, for the composite stress measure, perceived stress was weighted twice as heavily (67%) as severe life events (33%) because while life events may not render the same impact on all individuals, the subjective appraisal of stress arguably has a more direct effect on mental health during pregnancy as well as the behavioral and biological pathways leading to adverse obstetric outcomes. Additionally, severe life events are rare shocks, whereas perceived stress is more likely to be persistent and chronic. Therefore, the figure graphically depicts how each component was weighted and then summed to create the composite measures of personal capital and stress. Finally, the balance between personal capital and stress (empirically captured by the Stress-to-Capital Ratio) is hypothesized to lead to adverse obstetric outcomes.
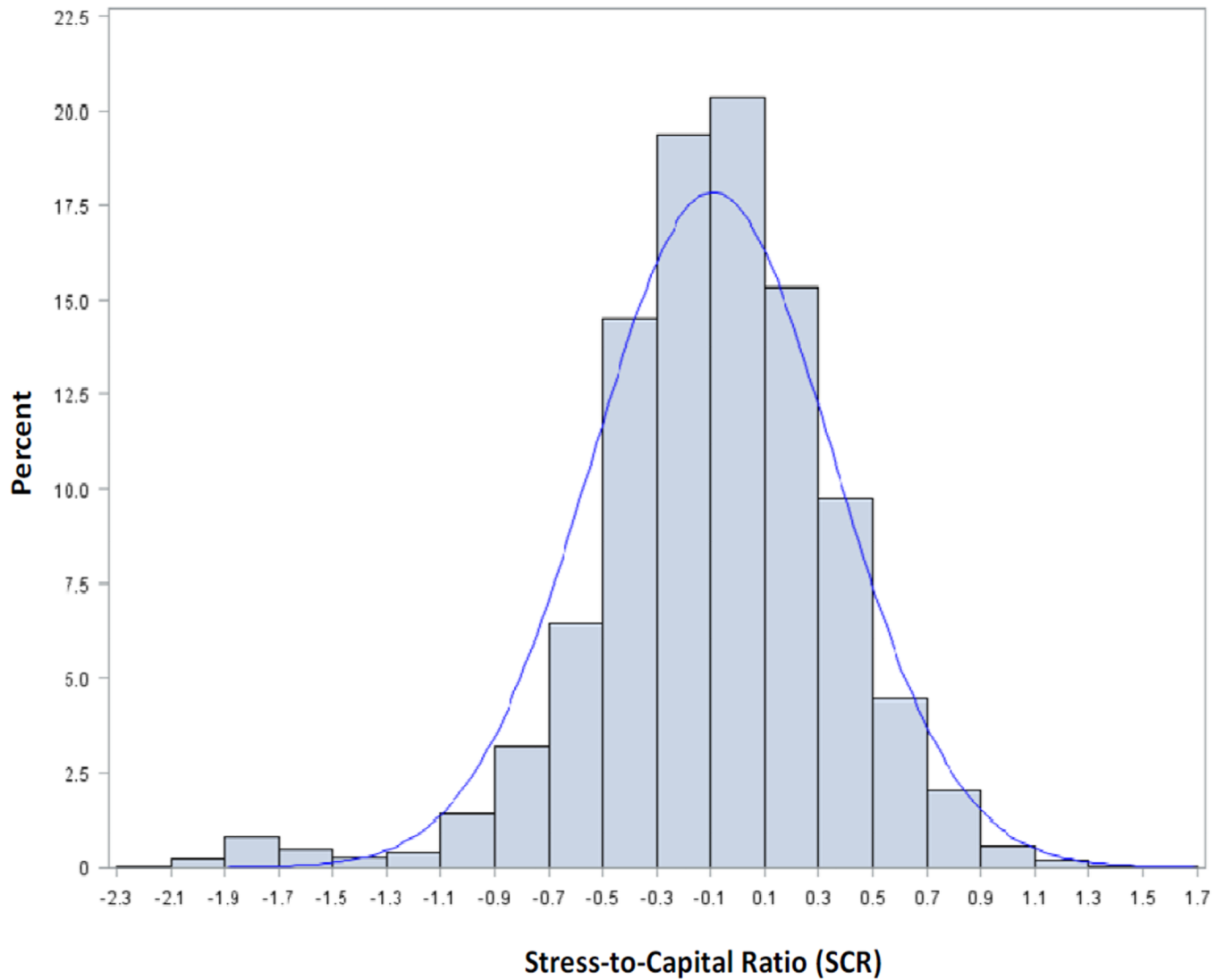
Figure 2. Distribution of the Stress-to-Capital Ratio (SCR) for 2007 LAMB Study Respondents
Legend: The histogram illustrates the distribution of the Stress-to-Capital Ratio (SCR) scores for the 2007 LAMB study respondents. The blue curve represents a normal distribution fit to the mean and standard deviation of the SCR. The mean SCR for the sample was −0.09, with a standard deviation of 0.45.

Table 1

Weighted Means of Stress-to-Capital Ratio Scores by Selected Maternal Sociodemographic and Health Characteristics, 2007 LAMB Study

		Stress-to-Capital Ratio		
Total	**Mean/%**	**Mean**	**SD**	**p-value**
Unweighted n=3,353		−0.09	0.45	
Weighted n=246,286		−0.07	0.46	
Sociodemographic factors				
Age	27.9			
18	7.4%	0.07	0.34	***
19–34	75.8%	−0.07	0.46	Ref
35	16.8%	−0.16	0.49	***
Race/ethnicity				
Non-Hispanic White	13.1%	−0.18	0.49	Ref
Non-Hispanic Black	4.7%	0.02	0.54	***
Hispanic	71.9%	−0.06	0.44	***
Asian/Pacific Islander	9.6%	−0.10	0.44	*
Native American	0.7%	−0.04	0.52	NS
Annual household income				
<$20,000	42.8%	0.05	0.42	***
$20,000-$39,000	23.0%	−0.12	0.45	**
$40,000-$59,000	9.3%	−0.12	0.42	*
$60,000-$99,000	10.4%	−0.21	0.44	Ref
>$ 100,000	9.4%	−0.30	0.48	**
Unknown	5.1%	−0.06	0.51	***
Education				
12 years (no HS diploma/GED)	33.0%	−0.04	0.42	*
HS diploma/GED	65.0%	−0.09	0.47	Ref
Unknown	2.0%	−0.06	0.42	NS
Marital status				
Married	54.5%	−0.19	0.47	Ref
Separated/Divorced/Widowed	2.9%	0.37	0.40	***
Single/never married	11.2%	0.23	0.43	***
Cohabiting	30.6%	−0.01	0.38	***
Unknown	0.8%	0.05	0.47	**
Service Planning Area (SPA)				
1 (Antelope Valley)	2.5%	0.08	0.56	***
2 (San Fernando Valley)	21.0%	−0.13	0.47	NS
3 (San Gabriel Valley)	18.8%	−0.07	0.44	NS
4 (Metro Los Angeles)	9.9%	−0.07	0.46	NS

	Stress-to-Capital Ratio			
Total	**Mean/%**	**Mean**	**SD**	**p-value**
5 (West)	2.5%	−0.16	0.58	Ref
6 (South)	15.0%	−0.02	0.42	**
7 (East)	14.0%	−0.05	0.43	*
8 (South Bay)	16.3%	−0.09	0.48	NS
Health factors				
Pre-pregnancy depression				***
Yes	14.9%	0.26	0.39	
No	85.1%	−0.13	0.45	
Pre-pregnancy health conditions (hypertension or diabetes)				
Yes	5.1%	0.05	0.40	
No	94.9%	−0.08	0.47	
Prenatal depressive symptoms				***
Yes	20.0%	0.30	0.34	
No	80.0%	−0.17	0.44	
Other control variables				
Parity				NS
Primaparous (no prior births)	37.7%	−0.08	0.45	
Multiparous (1 prior birth)	62.3%	−0.07	0.47	
Number of prior children under age 5				
0	58.8%	−0.08	0.46	Ref
1	35.1%	−0.08	0.47	NS
2	6.1%	0.04	0.47	***
Obstetric outcomes				
Pregnancy complications				***
Any (1)	44.3%	−0.02	0.45	
None (0)	55.7%	−0.12	0.47	
Gestational age	272.8 days			
Preterm (<259 days)	12.7%	0.00	0.48	***
Early-term (259–272 days)	29.4%	−0.07	0.45	NS
Late-term (>273 days)	57.9%	−0.09	0.47	Ref
Birthweight	3,284.9 grams			
Low (<2,500 grams)	7.5%	−0.05	0.51	NS
Normal (2,500–4,000 grams)	84.1%	−0.08	0.46	Ref
High (<4,000 grams)	8.3%	−0.06	0.41	NS
Small-for-gestational age				NS
Yes	10.5%	−0.07	0.48	
No	89.5%	−0.07	0.46	

Note: Weighted means and percentages accounted for sampling design and survey non-response. Ref - reference category; NS –not significant; p 0.05;

*
p<0.05;

**
p<0.01;

***
p<0.001

Table 2

Distribution of Stress, Personal Capital, and the Stress-to-Capital Ratio (SCR) Scores, 2007 LAMB Study

	Raw (Unweighted) Score		Weighted Score		Standardized Score		Cronbach's alpha
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range	
Stress Score	8.87 (5.29)	0.0–31.0	23.91 (14.03)	1.0–85.9	46.64 (11.81)	9.8–78.8	0.523
Perceived Stress	8.33 (4.91)	0.0–27.0					0.849
Severe Stressful Life Events	0.54 (0.89)	0.0–7.0					0.472
Personal Capital Score	63.01 (14.46)	19.0–98.0	71.85 (13.87)	12.1–98.3	50.00 (10.00)	14.3–81.6	0.477
Internal Resources	20.88 (4.67)	0.0–28.0					0.795
Partner Support	5.35 (1.35)	0.0–6.0					0.831
Social Network Support	18.35 (8.86)	0.0–28.0					0.919
Neighborhood Support	18.42 (6.82)	0.0–40.0					0.813

	Raw (Untransformed)		Log Transformed		Absolute Difference	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Stress-to-Capital Ratio	1.00 (0.43)	0.1–4.9	−0.09 (0.45)	−2.1–1.6	−3.36 (18.69)	−71.8–56.1

Table 3

Characteristics of 2007 LAMB Study Respondents by Pregnancy Complications and Multivariate Analysis of the Odds of Any Complications

	Total	Any complications Mean/%	No complications Mean/%	Any complication (vs. None) AOR	95% CI
TOTAL:					
Weighted	246,286	109,218	137,068		
Weighted %	100%	44.3%	55.7%		
TOTAL:					
Unweighted	3,353	1,497.34	1,856		
Unweighted %	100%	44.6%	55.4%		
Stress-to-Capital Ratio[c]		−0.02	−0.12	1.35	1.10, 1.65
Sociodemographic characteristics					
Age		27.9	27.9	1.01	0.99, 1.03
Race/ethnicity[c]					
Non-Hispanic White[b]		11.3%	14.5%	1.00	Reference
Non-Hispanic Black[b]		5.8%	3.8%	1.79	1.24, 2.58
Hispanic		73.3%	70.8%	1.22	0.97, 1.53
Asian/Pacific Islander		8.8%	10.3%	1.05	0.80, 1.39
Native American		0.8%	0.6%	1.01	0.45, 2.25
Annual household income[a]					
<$20,000		44.5%	41.5%	1.23	0.93, 1.63
$20,000-$39,000		23.4%	22.7%	1.28	0.97, 1.68
$40,000-$59,000		9.5%	9.2%	1.28	0.94, 1.73
$60,000-$99,000[a]		9.1%	11.4%	1.00	Reference
>$100,000[b]		8.0%	10.6%	0.99	0.74, 1.33
Unknown		5.5%	4.6%	1.45	0.92, 2.26
Education[a]					
12 years (no HS diploma/GED)		33.0%	33.0%	0.93	0.76, 1.14

	Total	Any complications	No complications		Any complication (vs. None)	
		Mean/%	Mean/%		AOR	95% CI
HS diploma/GED		64.1%	65.7%		1.00	Reference
Unknown[b]		2.9%	1.3%		2.19	1.21, 3.95
Marital status[a]						
Married[a]		52.2%	56.4%		1.00	Reference
Separated/Divorced/Widowed		3.4%	2.5%		1.09	0.64, 1.85
Single/never married[a]		12.9%	9.9%		1.06	0.80, 1.41
Cohabiting		30.8%	30.4%		0.96	0.78, 1.17
Unknown		0.7%	0.9%		0.76	0.30, 1.93
Service PlanninR Area (SPA)						
1 (Antelope Valley)		3.0%	2.2%		1.39	0.83, 2.35
2 (San Fernando Valley)		21.6%	20.5%		1.29	0.88, 1.90
3 (San Gabriel Valley)		18.0%	19.4%		1.10	0.74, 1.64
4 (Metro Los Angeles)		9.3%	10.3%		1.04	0.68, 1.61
5 (West)		2.1%	2.8%		1.00	Reference
6 (South)		14.8%	15.2%		1.04	0.68, 1.60
7 (East)		13.5%	14.4%		1.10	0.73, 1.66
8 (South Bay)		17.7%	15.2%		1.31	0.88, 1.94
Other control variables						
Pre-pregnancy depression[c]						
Yes		18.0%	12.5%		1.19	0.94, 1.52
No		82.0%	87.5%		1.00	Reference
Pre-pregnancy health conditions (hypertension or diabetes)[c]						
Yes		9.3%	1.9%		4.76	3.13, 7.30
No		90.7%	98.2%		1.00	Reference
Prenatal depressive symptoms[c]						
Yes		24.1%	16.8%		1.23	0.98, 1.5\4
No		75.9%	83.2%		1.00	Reference

	Total Any complications	No complications	Any complication (vs. None)	
	Mean/%	Mean/%	AOR	95% CI
Parity				
Primaparous (no prior births)	37.5%	37.9%	0.96	0.77, 1.20
Multiparous (1 prior birth)	62.5%	62.1%	1.00	Reference
Number of prior children under age 5	0.46	0.49	0.90	0.76, 1.06

For univariate analysis,

[a] p<0.05;

[b] p<0.01;

[c] p<0.001

Data are weighted to account for sampling design and survey non-respon se.

Note: The multivariate model included all variables listed in the table.

Table 4

Characteristics of 2007 LAMB Study Respondents by Infant Gestational Age and Multinomial Logistic Regression Analysis of the Odds of Preterm Birth and Early-term Birth

	Total	Preterm birth	Early-term birth	Late-term birth	Preterm birth (vs. Late-term birth)		Early-term birth (vs. Late-term birth)	
					Model 1	Model 2	Model 1	Model 2
	Mean/%	Mean/%	Mean/%	Mean/%	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
TOTAL:								
Weighted	246,286	31,229	72,394	142,663				
Weighted %	100%	12.7%	29.4%	57.9%				
TOTAL:								
Unweighted	3,353	499	956	1,898				
Unweighted %	100%	14.9%	28.5%	56.6%				
Stress-to-Capital Ratio		0.00[c]	−0.07	−0.09	1.44 (1.07, 1.93)	1.33 (0.98, 1.80)	1.18 (0.94, 1.47)	1.15 (0.92, 1.44)
Sociodemographic characteristics								
Age		27.9	28.4[b]	27.6	1.02 (1.00, 1.04)	1.02 (1.00, 1.04)	1.01 (1.00, 1.03)	1.01 (1.00, 1.03)
Race/ethnicity								
Non-Hispanic White		9.5%	12.2%	14.4%	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Non-Hispanic Black		4.5%	5.1%	4.5%	1.26 (0.72, 2.18)	1.07 (0.61, 1.88)	1.43 (0.96, 2.13)	1.36 (0.91, 2.04)
Hispanic		76.9%[b]	72.1%	70.7%	1.41 (0.97, 2.03)	1.35 (0.93, 1.95)	1.23 (0.96, 1.58)	1.22 (0.95, 1.56)
Asian/Pacific Islander		8.1%	10.0%	9.7%	1.19 (0.78, 1.81)	1.20 (0.78, 1.83)	1.18 (0.88, 1.58)	1.17 (0.87, 1.58)
Native American		1.0%	0.6%	0.7%	1.44 (0.52, 3.94)	1.48 (0.53, 4.15)	1.17 (0.46, 2.97)	1.18 (0.47, 2.97)
Annual household income								
<$20,000		45.3%[a]	42.1%	42.6%	1.33 (0.89, 2.00)	1.26 (0.83, 1.90)	0.91 (0.67, 1.25)	0.90 (0.66, 1.23)

	Total	Preterm birth Mean/%	Early-term birth Mean/%	Late-term birth Mean/%	Preterm birth (vs. Late-term birth) Model 1 AOR (95% CI)	Preterm birth (vs. Late-term birth) Model 2 AOR (95% CI)	Early-term birth (vs. Late-term birth) Model 1 AOR (95% CI)	Early-term birth (vs. Late-term birth) Model 2 AOR (95% CI)
$20,000-$39,000		26.0%[b]	23.8%	22.0%	1.55 (1.05, 2.30)	1.46 (0.97, 2.18)	1.00 (0.74, 1.35)	0.99 (0.73, 1.33)
$40,000-$59,000		8.3%	9.1%	9.7%	1.16 (0.73, 1.84)	1.06 (0.66, 1.70)	0.88 (0.63, 1.24)	0.87 (0.62, 1.22)
$60,000-$99,000		7.5%	11.1%	10.7%	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
>$ 100,000		6.5%	9.5%	10.0%	1.00 (0.63, 1.60)	1.00 (0.63, 1.59)	0.94 (0.69, 1.29)	0.94 (0.69, 1.29)
Unknown		6.4%[a]	4.5%	4.9%	1.83 (1.01, 3.34)	1.65 (0.89, 3.09)	0.88 (0.53, 1.46)	0.86 (0.52, 1.42)
Education								
12 years (no HS diploma/GED)		33.7%	33.6%	32.5%	0.88 (0.66, 116)	0.89 (0.67, 1.19)	1.03 (0.82, 1.30)	1.04 (0.83, 1.30)
HS diploma/GED		62.9%	64.7%	65.6%	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Unknown		3.4%	1.6%	1.9%	1.70 (0.82, 3.55)	1.37 (0.65, 2.90)	0.81 (0.39, 1.69)	0.77 (0.37, 1.59)
Marital status								
Married		49.1%	56.0%	55.0% (ref)	1.00	1.00 (ref)	1.00 (ref)	1.00 (ref)
Separated/ Divorced/ Widowed		3.4%	3.0%	2.7%	1.15 (0.59, 2.24)	1.16 (0.58, 2.32)	1.19 (0.68, 2.08)	1.18 (0.68, 2.08)
Single/never Married		12.6%	9.7%	11.7%	1.04 (0.70, 1.55)	1.04 (0.69, 1.56)	0.85 (0.61, 1.18)	0.84 (0.61, 1.18)
Cohabiting		34.7%[a]	29.8%	30.1%	1.18 (0.90, 1.56)	1.22 (0.92, 1.61)	1.02 (0.81, 1.27)	1.02 (0.81, 1.28)
Unknown		0.2%	1.5%[a]	0.6%	0.37 (0.05, 2.82)	0.40 (0.06, 2.95)	2.62 (1.09, 6.31)	2.67 (1.13, 6.29)
Service Planning Area (SPA)								
1 (Antelope Valley)		2.8%	2.7%	2.4%	1.36 (0.62, 2.97)	1.23 (0.55, 2.76)	1.33 (0.75, 2.36)	1.30 (0.73, 2.31)
2 (San Fernando Valley)		19.0%	21.5%	21.2%	1.23 (0.67, 2.27)	1.14 (0.61, 2.12)	1.28 (0.84, 1.97)	1.26 (0.82, 1.93)

	Total			Preterm birth (vs. Late-term birth)		Early-term birth (vs. Late-term birth)	
	Preterm birth Mean/%	Early-term birth Mean/%	Late-term birth Mean/%	Model 1 AOR (95% CI)	Model 2 AOR (95% CI)	Model 1 AOR (95% CI)	Model 2 AOR (95% CI)
3 (San Gabriel Valley)	17.6%	20.7%	18.1%	1.31 (0.70, 2.43)	1.26 (0.67, 2.38)	1.43 (0.93, 2.21)	1.42 (0.92, 2.20)
4 (Metro Los Angeles)	10.3%	9.2%	10.2%	1.33 (0.68, 2.58)	1.30 (0.66, 2.58)	1.12 (0.70, 1.81)	1.12 (0.69, 1.81)
5 (West)	1.8%	2.1%	2.8%	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
6 (South)	15.7%	14.7%	15.0%	1.25 (0.65, 2.41)	1.22 (0.62, 2.39)	1.15 (0.72, 1.85)	1.15 (0.71, 1.85)
7 (East)	15.0%	11.7%	15.0%	1.26 (0.67, 2.38)	1.21 (0.64, 2.32)	0.94 (0.59, 1.49)	0.93 (0.59, 1.48)
8 (South Bay)	17.8%	17.3%	15.5%	1.49 (0.81, 2.78)	1.37 (0.73, 2.58)	1.35 (0.87, 2.10)	1.33 (0.86, 2.07)
Other control variables							
Pre-pregnancy depression							
Yes	18.3%[a]	14.7%	14.3%	1.11 (0.80, 1.55)	1.06 (0.75, 1.49)	1.02 (0.78, 1.34)	1.01 (0.77, 1.32)
No	81.7%	85.3%	85.7%	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Pre-pregnancy health conditions (hypertension or diabetes)							
Yes	7.1%[a]	5.4%	4.6%	1.35 (0.87, 2.11)	0.93 (0.60, 1.44)	1.13 (0.76, 1.67)	1.00 (0.68, 1.49)
No	92.9%	94.6%	95.4%	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Prenatal depressive symptoms							
Yes	24.2%[a]	20.1%	19.1%	1.02 (0.75, 1.40)	0.95 (0.68, 1.33)	0.98 (0.76, 1.26)	0.96 (0.74, 1.24)
No	75.8%	79.9%	80.9%	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Parity							
Primaparous (no prior births)	34.3%[b]	32.3%[c]	41.2%	0.87 (0.64, 1.19)	0.87 (0.64, 1.19)	0.71 (0.56, 0.90)	0.71 (0.56, 0.90)
Multiparous (≥1 prior birth)	65.7%	67.7%	58.8%	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)

	Total	Preterm birth	Early-term birth	Late-term birth	Preterm birth (vs. Late-term birth)		Early-term birth (vs. Late-term birth)	
					Model 1	Model 2	Model 1	Model 2
		Mean/%	Mean/%	Mean/%	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Number of prior children under age 5		0.52	0.50	0.46	1.08 (0.86, 1.35)	1.12 (0.89, 1.40)	0.95 (0.80, 1.13)	0.96 (0.81, 1.15)
Obstetric outcomes								
Pregnancy complications								
Any		70.4% [c]	46.2% [c]	37.7%		3.77 (2.96, 4.80)		1.40 (1.18, 1.67)
None		29.6%	53.8%	62.3%		1.00 (ref)		1.00 (ref)

For univariate analysis,

[a] p<0.05;

[b] p<0.01;

[c] p<0.001

Data are weighted to account for sampling design and survey non-re sponse.

Note: Model 1 included all variables listed in the table except pregnancy complications. Model 2 included all variables in the table.

Table 5

Multivariate Linear Regression Analysis of Infant Gestational Age among 2007 LAMB Study Respondents

	Model 1		Model 2	
	Coefficient	95% CI	Coefficient	95% CI
Stress-to-Capital Ratio	**−2.21**[b]	**−3.84, −0.59**	**−1.78**[a]	**−3.37, −0.20**
Sociodemographic characteristics				
Age	−0.20[c]	−0.32, −0.08	−0.19[b]	−0.31, −0.07
Race/ethnicity				
Non-Hispanic White	1.0 0	Reference	1.00	Reference
NonHispanic Black	−0.37	−3.36, 2.61	0.48	−2.52, 3.47
Hispanic	−1.48	−3.25, 0.29	−1.20	−2.96, 0.57
Asian/Pacific Islander	−0.52	−2.51, 1.47	−0.44	−2.40, 1.51
Native American	−2.22	−7.42, 2.97	−2.22	−7.42, 2.99
Annual household income				
<$20,000	−1.34	−3.26, 0.59	−1.04	−2.94, 0.86
$20,000-$39,000	−2.20[a]	−4.06, −0.35	−1.85[a]	−3.67, −0.03
$40,000-$59,000	−0.37	−2.34, 1.60	−0.02	−1.96, 1.93
$60,000-$99,000	1.00	Reference	1.00	Reference
>$ 100,000	−0.23	−2.11, 1.65	−0.24	−2.08, 1.59
Unknown	−4.29[a]	−8.46, −0.11	−3.75	−7.90, 0.39
Education				
12 years (no HS diploma/GED)	1.40	−0.20, 3.00	1.30	−0.30, 2.90
HS diploma/GED	1.00	Reference	1.00	Reference
Unknown	−1.14	−4.86, 2.58	−0.02	−3.62, 3.59
Marital status				
Married	1.0 0	Reference	1.0 0	Reference
Separated/Divorced/Widowed	−1.03	−5.06, 2.99	−0.91	−4.93, 3.10
Single/never married	−1.45	−3.86, 0.96	−1.36	−3.74, 1.03
Cohabiting	−1.39	−2.95, 0.17	−1.46	−2.99, 0.08
Unknown	2.00	−3.72, 7.71	1.59	−3.56, 6.73
Service Planning Area (SPA)				
1 (Antelope Valley)	−0.51	−4.56, 3.54	−0.05	−4.09, 3.99
2 (San Fernando Valley)	−0.99	−3.63, 1.65	−0.61	−3.18, 1.96
3 (San Gabriel Valley)	−1.87	−4.52, 0.79	−1.72	−4.32, 0.87
4 (Metro Los Angeles)	−1.13	−4.15, 1.88	−1.07	−4.04, 1.90
5 (West)	1.00	Reference	1.00	Reference
6 (South)	−1.21	−4.26, 1.83	−1.15	−4.12, 1.81
7 (East)	−0.77	−3.64, 2.10	−0.64	−3.45, 2.17
8 (South Bay)	−2.67	−5.50, 0.16	−2.28	−5.03, 0.46

Other control variables

	Model 1		Model 2	
	Coefficient	95% CI	Coefficient	95% CI
Stress-to-Capital Ratio	**−2.21**[b]	**−3.84, −0.59**	**−1.78**[a]	**−3.37, −0.20**
Pre-pregnancy depression				
	−0.33	−2.40, 1.75	−0.07	
Yes				−2.12, 1.99
No	1.00	Reference	1.00	Reference
Pre-pregnancy health conditions (hypertension or diabetes)				
Yes	−2.62	−5.45, 0.21	−0.54	−3.33, 2.25
No	1.00	Reference	1.00	Reference
Prenatal depressive symptoms				
Yes	0.22	−1.74, 2.19	0.53	−1.42, 2.48
No	1.00	Reference	1.00	Reference
Parity				
Primaparous (no prior births)	1.02	−0.71, 2.76	0.97	−0.74, 2.68
Multiparous (1 prior birth)	1.00	Reference	1.00	Reference
Number of prior children under age 5	−0.66	−2.11, 0.79	−0.82	−2.26, 0.63
Obstetric outcomes				
Pregnancy complications				
Any			−6.22[c]	−7.43, −5.01
None	1.0 0	Reference	1.00	Reference

[a]p<0.05;

[b]p<0.01;

[c]p<0.001

Data are weighted to account for s ampling design and survey non-resp onse.

Note: Model 1 included all variables listed in the table except pregnancy complications . Model 2 included all variables listed in the table.

Appendix A

Stress and Personal Capital Items Included in the Stress-to-Capital Ratio (SCR)

Measure	Origin of Scale	Items in Measure	Possible Responses
Stress Index			
Perceived Stress	LAMB 9-item version of Cohen's Perceived Stress Scale (PSS)[1]		Never; Occasionally; Fairly often; Always
		How much of the time, during your most recent pregnancy, had you:	
		Been a very nervous person; felt calm and peaceful [*]; felt sad; been a happy person [*]; been upset because of something that happened unexpectedly; felt that you were unable to control the important things in your life; felt that things were going your way [*]; felt difficulties were piling up	
		so high that you could not overcome them; felt so down in the dumps that nothing could cheer you up?	
Severe Life Events	Subset of LAMB 14-item stressful life events list, adapted from modified life event inventory in Pregnancy Risk Assessment Monitoring System (PRAMS)[2]	During pregnancy, did these events happen to you?	Yes; No
		You got separated or divorced from your husband or partner; were homeless; lost your job even though you wanted to go on working; were in a physical fight; your husband or partner lost his job; you or your husband or partner went to jail; someone close and important to you died.	
Personal Capital Index			
Internal Resources		Here is a list of statements dealing with your feelings about yourself during your last pregnancy	Strongly disagree; Disagree; Neither disagree nor agree; Agree; Strongly agree
Selfesteem	3-item Rosenberg Self-Esteem Scale Short Form[3]	On the whole, I am satisfied with myself; feel that I'm a person of worth, at least on an equal plane with others; am able to do things as well as most other people.	
Mastery	4-item Pearlin Mastery Scale Short Form[3]	I have little control over the things that happen to	

Measure	Origin of Scale	Items in Measure	Possible Responses
		me [*]; there is really no way I can solve some of the problems I have [*]; sometimes I feel that I am being pushed around in life [*]; I can do just about anything I really set my mind to do.	
Partner Support	Fragile Families Study[4]	During your last pregnancy, did the baby's father do any of the following? Gave you money or brought things for you; helped you in other ways, such as taking you to the doctor or helping with chores; gave you emotional support in labor; visited you and the baby at the hospital after the delivery; wanted to put his name on the baby's birth certificate as the father; said he wanted to help you raise your child in the coming years.	Yes; No
Social network Support	PRAMS[5]	During your last pregnancy, how often would you get these kinds of supports, if you needed them? Someone to loan me $50; help me if I were sick and needed to be in bed; take me to the clinic or doctor if I needed a ride; give me a place to live; help me with babysitting or child care; help me with household chores; talk to about my problems.	Never; Rarely; Sometimes; Most of the time; All the time
Neighborhood Support	Project on Human Development in Chicago Neighborhoods (PHDCN)[6]		
Social Cohesion		Do you agree that people in your neighborhood… Are willing to help their neighbors; this is a close-knit (tight) neighborhood; can be trusted; generally, don't get along with each other [*]; do not share the same values [*].	Strongly disagree; Disagree; Neutral; Agree; Strongly agree
Reciprocal Exchange		And how often do your neighbors… Do favors for each other; ask each other advice about personal things	Never; Almost never; Sometimes; Fairly often; Very often

Measure	Origin of Scale	Items in Measure	Possible Responses
		such as child rearing or job openings; have parties or other get-togethers where other people in the neighborhood are invited; visit in each other's homes or on the street; watch over each other's property?	

*
Reverse-coded items

[1]
Cohen et al., 1983;

[2]
Newton & Hunt, 1984;

[3]
Marks & Lambert, 1999;

[4]
Fragile Families Study, 2003;

[5]
Adams, et al., 1991;

[6]
Buka, et al., 2003