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Stress and Anxiety are Associated with Lower Gestational Weight Gain in Hispanic Women

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Abstract

Purpose—Prior studies indicate that inadequate and excessive gestational weight gain (GWG) are associated with poor maternal and infant outcomes, and that stress and anxiety may contribute to GWG. However, these studies often failed to utilize validated measures of stress and anxiety, measured only total GWG, and were limited to largely non-Hispanic White populations. We explored the association between stress and anxiety and GWG.

Basic Procedures—We used data from 1,308 participants in Proyecto Buena Salud, a prospective cohort of predominantly Puerto Rican women 18–40 years of age (2006–2012). We measured stress with the Perceived Stress Scale and anxiety with the State-Trait Anxiety Scale, and abstracted GWG from medical records.

Main Findings—Average GWG was 31 pounds (SD=16.1 lbs). More than half of participants (51.8%) exceeded Institute of Medicine guidelines for GWG. After adjusting for age and pre-pregnancy body mass index (BMI), women in the highest quartiles of stress and anxiety in early pregnancy had approximately 4 lbs lower GWG ($\beta=-3.89$, SE=1.54, $p=0.012$ and $\beta=-4.37$, SE=1.54, $p=0.005$, respectively) as compared to those in the lowest quartiles. Similarly, women in the highest quartiles of mid/late pregnancy stress and anxiety had lower GWG ($\beta=-3.84$ lbs, SE=1.39, $p=0.006$, and $\beta=-3.51$ lbs, SE=1.38, $p=0.011$, respectively) and lower rate of GWG in the 2nd and 3rd trimesters ($\beta=-0.117$ lbs/week, SE=0.044, $p=0.008$ and $\beta=-0.116$ lbs/week, SE=0.043, $p=0.007$, respectively), compared to those in the lowest quartiles.

Principal Conclusions—High stress and anxiety were associated with lower GWG. Interventions to reduce stress and anxiety during pregnancy should include counseling on maintaining healthy GWG.

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Introduction

Inadequate or excessive gestational weight gain (GWG), according to the Institute of Medicine (IOM) recommended guidelines, is associated with adverse outcomes, including preterm birth, low birthweight, small-for-gestational-age infants, failure to initiate breastfeeding, high birthweight, macrosomia, large-for-gestational-age infants, increased risk for cesarean delivery, postpartum maternal weight retention, and higher long-term offspring BMI (Institute of Medicine, 2009; Johnson et al., 2013; Mamun et al., 2009; Oken & Gillman, 2003; Siega-Riz et al., 1994; Stotland et al., 2006; Viswanathan et al., 2008).

Nearly three-quarters (70%) of women in the US do not achieve GWG within IOM recommendations (Goldstein et al., 2017). For example, women with overweight or obesity before pregnancy are more likely to have excessive GWG than women who have a body mass index (BMI) in the normal range (Deputy et al., 2015). Hispanic women have the second highest rate of pre-pregnancy obesity in the US (44.%) (Prevalence of Obesity and Severe Obesity Among Adults: United States, 2017–2018, 2020), placing them at elevated risk of excessive GWG. This is supported by recent data indicating that 77% of Hispanic women do not have GWG within IOM recommendations (Sangi-Haghpeykar et al., 2014).

This is critical because Hispanic people are the largest and fastest growing ethnic group in the US. It is estimated that the percentage of Hispanic women of childbearing age will increase 74% by 2060, in contrast to an expected 35% decline in non-Hispanic White women (March of Dimes Special Report: Maternal and Infant Health in US Hispanic Populations., 2014). Hispanic people from the Caribbean islands (i.e., Puerto Ricans and Dominicans) are a particularly fast growing subgroup in the US and, compared to other Hispanic subgroups, experience the greatest health disparities, least education, and lowest incomes (Hajat et al., 2000; Zsembik & Fennell, 2005).

The impact of perceived stress on weight may involve a complex interaction of genetics, health, race/ethnicity, socioeconomic status, and environmental factors (Davis et al., 2012). Stress and anxiety may impact GWG through coping skills, as they relate to health behaviors such as eating, physical activity, and weight gain restrictive behaviors (Davis et al., 2012; Dipietro et al., 2003; Hill et al., 2013). Research indicates that high stress can lead to over and under eating behaviors, and that the balance of acute and chronic stress may influence eating behavior. Whereas high levels of chronic stress may lead to overeating (Torres & Nowson, 2007), high levels of chronic stress combined with an acutely stressful event (such as pregnancy) may lead to undereating and less weight gain. For example, prior studies suggest that chronic stress, such as perceived poverty, food insecurity, lack of access to quality education, and unsafe environments experienced by many Puerto Rican women (Bermúdez-Millán et al., 2011) may lead to overeating and excess weight (Koleilat & Whaley, 2013). However, pregnancy may be considered an acute source of stress, both physiologically and emotionally (González-Ochoa et al., 2018), and the addition of this acute stressor may lead to further disturbances in diet and hunger, and subsequent undereating among susceptible women with high chronic stress (Torres & Nowson, 2007).

Another pathway through which stress and anxiety may impact GWG is hormonal. High levels of stress and anxiety may contribute to hyper- or hypo-activation of the hypothalamic–pituitary–adrenal (HPA) axis. This in turn can lead to less fat synthesis in adipose tissue and/or reduced uptake of glucose in muscle and other insulin-sensitive tissues, resulting in lower weight gain than would be expected from a given caloric intake (Epel et al., 2001; Hobel et al., 1998; Pasquali et al., 2006; Picone et al., 1982; Rosso, 1988).

Stress and anxiety are relatively common during pregnancy but levels depend on the population under study. Research suggests that levels are higher in Hispanic as compared to non-Hispanic White populations (Borders et al., 2015; Chasan-Taber et al., 2010; Eichler et al., 2019; Silveira et al., 2012).

Existing research on the associations between stress and GWG is sparse and conflicting. Some prior studies found no association between levels of stress and subsequent GWG (Chasan-Taber et al., 2008; Dolin et al., 2020; Hartley et al., 2016; McPhie et al., 2015; Webb et al., 2009; Weisman et al., 2010). In contrast, other studies found that women with the lowest levels of stress were more likely to have adequate GWG (Kominiarek et al., 2018), and that higher levels of stress were associated with greater total GWG (Eichler et al., 2019; Matthews et al., 2018) or with lower total GWG (Braig et al., 2020). However, only five of these studies measured stress with an assessment tool validated for use during pregnancy (Chasan-Taber et al., 2008; Hartley et al., 2016; Matthews et al., 2018; McPhie et al., 2015; Webb et al., 2009).

Similarly, the association between anxiety and GWG is sparse and inconsistent, with some prior studies finding no association between anxiety and GWG (Claesson et al., 2010; Webb et al., 2009) and others finding that higher levels of anxiety were associated with greater total GWG (Braig et al., 2020; Hartley et al., 2016; Matthews et al., 2018). Only two of these prior studies specified that their measure of anxiety was validated for use during pregnancy (Matthews et al., 2018; Webb et al., 2009).

Overall, the prior literature is limited by inconsistent findings that may be due, in part, to reliance upon measures of stress or anxiety that were not validated for use during pregnancy or consideration of total GWG without an evaluation of trimester-specific GWG. In addition, the majority of prior research was conducted among non-Hispanic White women who, in general, reported lower overall levels of stress and anxiety. Therefore, we examined the associations between stress and anxiety in early and mid/late pregnancy and total GWG, GWG in the first trimester, and rate of GWG in the second and third trimesters using validated measures among participants in Proyecto Buena Salud (PBS), a study of Hispanic women of predominantly Puerto Rican descent.

Materials and Methods

Study Design

PBS was a prospective cohort study of Hispanic prenatal care patients in Western Massachusetts conducted from January 2006 through October 2012 (Chasan-Taber et al., 2010). Bilingual interviewers recruited patients at a prenatal care visit early in pregnancy

prior to 18 weeks gestational age (GA). Women were informed of the aims and procedures of the study and provided written informed consent approved by the Institutional Review Boards of the University of Massachusetts Amherst and Baystate Medical Center. The study consisted of structured interviews in early (M GA=12.5 wks, SD=3.2) and mid/late pregnancy (M GA=27.6 wks, SD=5.6), which were conducted in person or on the phone in Spanish or English (based on the participant's preference). After delivery, medical records were abstracted for clinical characteristics of the current pregnancy and medical and obstetrical history.

Eligibility was restricted to Caribbean Islanders (i.e., women of Puerto Rican or Dominican Republic ancestry) defined according to the US census as having been born in the Caribbean Islands, having a parent who was born in the Caribbean Islands, or having two grandparents who were born in the Caribbean Islands. Exclusion criteria included 1) taking medications thought to adversely influence glucose tolerance, 2) multiple gestation, 3) preconception history of diabetes, hypertension, heart disease, or chronic renal disease and 4) <16 or >40 years of age at enrollment. Women were also excluded if information on GWG was missing, or if they had a spontaneous or therapeutic abortion, a stillbirth, a preterm birth (<37 weeks gestation), or a late term birth (>42 weeks gestation), as the mechanism linking stress, anxiety, and GWG would likely not be comparable to women who delivered a live infant at term.

Stress

Psychosocial stress was measured using Cohen's Perceived Stress Scale (PSS-14), which includes 14 questions that address control over the demands of daily life, and includes questions such as "How often have you felt you were on top of things" and "How often have you felt nervous and stressed?" Participants answered each question on a 5-point scale, ranging from never (0) to always (4). Positively worded items were reverse scored and responses were summed for a total score ranging from 0–56. Higher scores indicate more perceived stress. Perceived stress in early and mid/late pregnancy were analyzed as continuous variables and additionally categorized into quartiles.

The PSS has been validated among pregnant women. For example, a 10-item version was internally consistent ($r=0.90$) and valid when compared against the Edinburgh Postnatal Depression Scale ($r=0.67$, $p<.001$) (Karam et al., 2012). The Spanish version of the PSS-14 has adequate test-retest reliability ($r=0.73$), internal consistency ($\alpha=0.81$), and validity with the Hospital Anxiety and Depression Scale (HADS) ($r=0.71$ for HADS-distress and $r=0.66$ for HADS-anxiety) (Remor, 2006).

Anxiety

Anxiety was measured using the Spielberger State-Trait Anxiety Inventory (STAI). The STAI-trait measures stable differences in proneness to anxiety and consists of 20 statements about how the participant generally feels, including "I am a steady person" and "I lack self-confidence." The STAI-state measures conditional levels of anxiety and consists of 20 statements about how the participant feels at the time of interview, including "I feel satisfied" and "I feel jittery." For both, questions are answered on a 4-point scale ranging

from never (1) to almost always (4). Positively worded items were reverse scored. Responses were summed for a total score ranging from 20–80. Higher scores indicate higher levels of anxiety. Trait anxiety (measured in early pregnancy) and state anxiety (measured in mid/late pregnancy) were analyzed as continuous variables and additionally categorized into quartiles.

The STAI has been validated among pregnant women. Gunning et al. found state anxiety and trait anxiety significantly associated with open-ended responses to how women feel about their pregnancy ($F[2,174]=9.699$, $p<.001$ and $F[2,174]=8.877$, $p<.001$, respectively) (Gunning et al., 2010). The STAI has been adapted for use in Spanish, and has been validated by TEA Editions (Spielberger et al., 1982).

Gestational Weight Gain

Total GWG was calculated by subtracting pre-pregnancy weight from weight at delivery and was analyzed as a continuous variable and additionally categorized as “inadequate,” “within guidelines,” or “excessive” based on the IOM’s 2009 pre-pregnancy body mass index (BMI) specific GWG guidelines. Specifically, all women, regardless of pre-pregnancy BMI, are advised to gain 1.1–4.4 lbs. in the first trimester. Over the entire pregnancy, women with a BMI in the underweight category are advised to gain a total of 28–40 lbs. (1.0–1.3 lbs. per week), women with a BMI in the normal weight category are advised to gain a total 25–35 lbs. (0.8–1.0 lbs per week), women with a BMI in the overweight category are advised to gain a total of 15–25 lbs.(0.5–0.7 lbs. per week), and women with a BMI in the obese category are advised to gain a total of 11–20 lbs. (0.4–0.6 lbs. per week) (Institute of Medicine, 2009).

GWG in the first trimester was calculated by subtracting self-reported pre-pregnancy weight from weight measured at the prenatal care visit closest to 13 weeks GA ($M=13.0$ wks, $SD=1.3$) and was analyzed as a continuous variable and additionally categorized as “inadequate,” “within guidelines,” or “excessive.” If self-reported pre-pregnancy weight was unavailable, clinically measured weight during the first prenatal visit was used (fewer than 2% of participants).

Rate of GWG in the second and third trimesters was calculated as total GWG between 13 weeks GA and delivery divided by the number of weeks between 13 weeks and delivery and was analyzed as a continuous variable and additionally categorized as “inadequate,” “within guidelines,” or “excessive.”

Covariates

Potential confounders assessed via interview included age, marital status, education, number of adults and children in the household, smoking during early pregnancy, alcohol consumption during early pregnancy, generation in the United States, and acculturation (with the Psychological Acculturation Scale) (Tropp et al., 1999). Depressive symptoms and physical activity (MET hrs/wk) were measured in early and mid/late pregnancy (with the Edinburgh Depression Scale and Pregnancy Physical Activity Questionnaire, respectively) (Chasan-Taber et al., 2004; Cox et al., 1987; Jadresic et al., 1995). Total energy intake was measured in mid/late pregnancy via 24-hour diet recalls. Gravidity, parity, age, pre-

pregnancy BMI, infant birth weight, and GA at delivery were abstracted from medical records.

Statistical Analyses

Participant characteristics and the distribution of stress, anxiety, and GWG was computed. Unadjusted and multivariable logistic regression models were used to evaluate the associations between stress, anxiety and GWG.

A priori we chose to include age in our multivariable models, given that the prior literature has established relationships between age and GWG. We included covariates in the final model if they changed the estimate for the primary exposure by 10% or more (Lee, 2014). Based upon this method, pre-pregnancy BMI was included in our final models. Analyses were performed using SAS software, Version 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

A total of 1,583 participants were recruited into PBS between 2006 and 2012. The final sample for analysis included 1,308 Hispanic women, after excluding 42 women missing information on GWG, 77 women who had a spontaneous or therapeutic abortion or a stillbirth, 124 women who had a preterm birth, and 1 woman who had a late term birth. The number of women in each analysis varied depending on missing exposure or outcome data. Women in the sample were generally young (71% less than 24 years of age), unmarried (88%), and had less than a high school education (48%). Approximately half of the women were born in the continental US (48%) and 48.3% had overweight or obesity before pregnancy.

Stress scores ranged from 3–54 (possible range: 0–56) (Table 1). The average stress score was 26.1 (SD=7.0) in early pregnancy, and 24.4 (SD=7.3) in mid/late pregnancy. Trait anxiety, measured in early pregnancy, ranged from 20–76 (possible range: 20–80). Average trait anxiety in early pregnancy was 40.2 (SD=10.3). State anxiety, measured in mid/late pregnancy, ranged from 20–79 (possible range: 20–80). Average state anxiety was 33.4 (SD=11.0).

Women gained an average of 3.8 pounds (SD=7.9 lbs.) during the first trimester and the average total GWG was 31.0 pounds (SD=16.1 lbs.) (Table 1). More than half of the women (51.8%) exceeded IOM recommendations for GWG and just under 20% of women had inadequate GWG. Similarly, 63.4% had an excessive rate of GWG in the second and third trimesters, while 19.9% had an inadequate rate of GWG.

Early Pregnancy Stress/Anxiety

We evaluated the associations between early pregnancy stress and anxiety and GWG. After adjusting for age and pre-pregnancy BMI, women in the highest quartile of stress in early pregnancy had lower GWG in the first trimester, compared to women in the lowest quartile of stress ($\beta=-1.70$, $SE=0.85$, $p=0.046$) (Table 2). We found no association between anxiety in early pregnancy and GWG in the first trimester. After adjusting for age and pre-pregnancy BMI, we found that women in the highest quartile of stress in early pregnancy had

significantly lower total GWG, compared to women in the lowest quartile of stress ($\beta = -3.89$, $SE = 1.54$, $p = 0.012$) (Table 3). Similarly, women in the highest quartile of anxiety in early pregnancy had significantly lower total GWG, compared to women in the lowest quartile of anxiety ($\beta = -4.37$, $SE = 1.54$, $p = 0.005$).

We then evaluated the associations between early pregnancy stress and anxiety and rate of GWG (Table 4). We found no association between stress in early pregnancy and rate of GWG in the second and third trimesters; however, women in the highest quartile of anxiety in early pregnancy had significantly lower rates of GWG in the second and third trimesters, compared to women in the lowest quartile of anxiety ($\beta = -0.114$, $SE = 0.047$, $p = 0.016$).

We found no association between stress or anxiety in early pregnancy and meeting IOM recommendations for GWG or for rate of GWG.

Mid/Late Pregnancy Stress/Anxiety

We evaluated the associations between mid/late pregnancy stress and anxiety and GWG. After adjusting for age and pre-pregnancy BMI, we found that women in the highest quartile of stress in mid/late pregnancy had significantly lower total GWG, compared to women in the lowest quartile of stress ($\beta = -3.84$, $SE = 1.39$, $p = 0.006$) (Table 5). Similarly, women in the highest quartile of anxiety in mid/late pregnancy had significantly lower total GWG, compared to women in the lowest quartile of anxiety ($\beta = -3.51$, $SE = 1.38$, $p = 0.011$).

We then evaluated the association between mid/late pregnancy stress and anxiety and rate of GWG. We found that women in the highest quartile of stress in mid/late pregnancy had a significantly lower rate of GWG in the second and third trimesters, compared to women in the lowest quartile of stress ($\beta = -0.117$, $SE = 0.044$, $p = 0.008$) (Table 6). We additionally found that women in the highest quartile of anxiety in mid/late pregnancy also had a significantly lower rate of GWG in the second and third trimesters, compared to women in the lowest quartile of anxiety ($\beta = -0.116$, $SE = 0.043$, $p = 0.007$).

We found no association between mid/late pregnancy stress or anxiety and meeting IOM recommendations for GWG or for rate of GWG.

Discussion

In this prospective cohort of predominantly Puerto Rican women, we found that women with the highest levels of perceived stress and anxiety in early pregnancy had, on average, 4–5 lbs lower total GWG as compared to women with low levels of these factors, after adjusting for important risk factors. Similarly, high stress and anxiety in mid/late pregnancy was associated with, on average, 3–4 lbs lower total GWG as well as a lower rate of GWG in the second and third trimesters. We also found that high stress in early pregnancy was associated with lower GWG in the first trimester, while anxiety was not. We did not find an association between pregnancy stress and anxiety and odds of meeting IOM GWG guidelines.

Our observed levels of stress and anxiety in early and in mid/late pregnancy indicate that women in this sample were, on average, more stressed and anxious than general population samples (Cohen, 1988; Knight et al., 1983). Specifically, our findings are consistent with

findings in prior studies among predominantly Puerto Rican populations that indicate that more than one-quarter of Puerto Rican women experience high levels of psychosocial stress during pregnancy and up to one-third of Puerto Rican women (Silveira et al., 2012) experience high levels of anxiety during pregnancy (Chasan-Taber et al., 2010). In contrast, in other predominantly non-Hispanic White populations, less than 10% of women report experiencing high levels of stress or anxiety during pregnancy (Eichler et al., 2019). Our finding that stress and anxiety decreased from early pregnancy to late pregnancy is also consistent with prior studies (Chasan-Taber et al., 2010; Grant et al., 2008; Silveira et al., 2012).

Women gained an average of 31.0 pounds during pregnancy and, while more than half of the women (51.8%) exceeded IOM recommendations for GWG, almost one-quarter of women had inadequate GWG. These findings mirror rates seen in another study of Hispanic women, which observed an average GWG of 27.9 pounds and only 24% gaining within recommended guidelines (Sangi-Haghpeykar et al., 2014). It is interesting to note that although Puerto Rican women experience overall higher levels of stress, anxiety, and excessive GWG as compared to non-Hispanic White women, that among this group those with the highest levels of stress and anxiety were more likely to have lower GWG. These findings provide additional support for conclusions that, for women experiencing chronically high levels of chronic stress and anxiety, the additional stress of pregnancy may lead to diet disturbances and undereating (Bermúdez-Millán et al., 2011; González-Ochoa et al., 2018; Torres & Nowson, 2007). However, viewing pregnancy as an acute stressor may be limited by the absence of an integrated view of stress (González-Ochoa et al., 2018). For example, while gestational stress increases the risk of pregnancy miscarriages and predisposes the mother to perinatal infections, premature labor, hemorrhages, and preeclampsia, this model does not take into account the interaction of what is perceived as stressful by the pregnant woman and the subsequent stress coping mechanisms and resilience (González-Ochoa et al., 2018;)

Our findings that high stress in pregnancy was associated with a lower rate of and total GWG are also consistent with and expand upon the results of some prior studies. For example, Braig et al. (2020) conducted a prospective cohort study of pregnant women in Germany using the Trier Inventory of Chronic Stress to measure stress and the Pregnancy Related Anxiety Questionnaire to measure anxiety. The authors found that women with stress in the highest tertile, as measured just after delivery, gained an average of 3.2 pounds less than women with stress in the lowest tertile. In contrast, women in the highest tertile of anxiety gained an average of 3.2 pounds more than women in the lowest tertile of anxiety (Braig et al., 2020). Other studies have found no association between stress and GWG (Chasan-Taber et al., 2008; Dolin et al., 2020; Hartley et al., 2016; McPhie et al., 2015; Webb et al., 2009; Weisman et al., 2010) or anxiety and GWG (Claesson et al., 2010; Webb et al., 2009). Notably, our study differed from most prior studies in the ethnic make-up of the population and the prospective use of validated measures of stress and anxiety.

Our study had several strengths, including the prospective design, use of measures of stress and anxiety validated in pregnancy, trimester-specific measures of GWG, and the focus on a high-risk Hispanic population. There were no natural disasters in the Springfield area during

this time that would have complicated control of environmental stressors. The study did, however, overlap with the recession of 2007–2009 (*US Business Cycle Expansions and Contractions*, 2020). The unemployment rate in Springfield, Massachusetts ranged from 5.3% in 2006 to 7.7% in 2012, with a peak of 9.2% in 2010 (*Bureau of Labor Statistics Data*, 2020). To the extent that these stressors were independently associated with GWG, they could have biased our observed results. In addition, our study also faced several other limitations. First, we relied primarily upon self-reported pre-pregnancy weight, as recorded by trained health assessors or health professionals at the first prenatal visit. However, self-reported pre-pregnancy weight is commonly used because preconception weight measures typically do not exist in medical record data (Institute of Medicine, 2009). Second, Cohen's Perceived Stress Scale and the State-Trait Anxiety Inventory were not designed to be diagnostic tools, and there are no established cut-points for high stress or anxiety.

Finally, Proyecto Buena Salud utilized the overall category of “Caribbean Islanders” to be consistent with census categories (Chasan Taber, et al., 2010) and therefore included both Puerto Ricans and Dominicans but did not distinguish between the two. However, Puerto Ricans comprise 85.9% of the Hispanic population in Springfield, Massachusetts, the study site (U.S. Census Bureau ACS Demographic and Housing Estimates, 2018). Levels of stress and anxiety among women from this Hispanic subgroup may differ from levels found among non-Hispanic White women or those from other Hispanic subgroups (e.g., Mexican American people) and our findings may not be generalizable to non-Hispanic populations or other Hispanic subgroups.

Implications for Practice and/or Policy

To our knowledge, this is the first study to examine the association between stress, anxiety, and GWG among a predominantly Puerto Rican population. We found that high levels of stress and anxiety during pregnancy were associated with lower total GWG and lower rate of GWG. Our findings suggest interventions among this ethnic group that aim to reduce stress and anxiety during pregnancy should include counseling on maintaining healthy GWG. Future research should focus on culturally specific interventions to reduce high levels of stress and anxiety, and should evaluate if changes in GWG associated with stress or anxiety impact subsequent birth outcomes.

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Biography

Megan Ward Harvey, PhD, is an Assistant Professor of Health Science at Springfield College. Her research focuses on maternal health, weight related health, and stress, particularly among vulnerable populations.

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Table 1.

Distribution of perceived psychosocial stress, anxiety, and GWG variables: Proyecto Buena Salud, 2006–2012.

	N	%	Mean	SD
Perceived Psychosocial Stress				
Early Pregnancy	839		26.1	7.0
Mid/Late Pregnancy	1062		24.4	7.3
Anxiety				
Early Pregnancy Trait Anxiety	894		40.2	10.3
Mid/Late Pregnancy State Anxiety	996		33.4	11.0
Gestational Weight Gain (lbs)				
1st Trimester (lbs)	1009		3.8	7.9
Adherence to IOM ^a Guidelines				
Inadequate	381	37.8%		
Within Guidelines	177	17.5%		
Excessive	451	44.7%		
Total Pregnancy (lbs)	1202		31.0	16.1
Adherence to IOM ^a Guidelines				
Inadequate	230	19.5%		
Within Guidelines	338	28.7%		
Excessive	611	51.8%		
Rate of Gestational Weight Gain (lbs/week)				
2nd and 3rd Trimesters (lbs/week)	944		1.0	0.5
Adherence to IOM ^a Guidelines for Rate				
Inadequate	187	19.9%		
Within Guidelines	157	16.7%		
Excessive	596	63.4%		

^aInstitute of Medicine.

Table 2.

Early Pregnancy Perceived Psychosocial Stress and Anxiety and GWG in the 1st Trimester: Proyecto Buena Salud, 2006–2012.

	Unadjusted			Adjusted ^a		
	β	(SE)	p-value	β	(SE)	p-value
Perceived Psychosocial Stress	-0.09	(0.04)	p=0.040	-0.074	(0.043)	p=0.086
Perceived Psychosocial Stress						
1st quartile	Referent	-	-	Referent	-	-
2nd quartile	-0.03	(0.85)	p=0.068	0.21	(0.84)	p=0.798
3rd quartile	-0.60	(0.83)	p=0.473	-0.13	(0.82)	p=0.875
4th quartile	-1.85	(0.86)	p=0.032	-1.70	(0.85)	p=0.046
Trait Anxiety	-0.04	(0.03)	p=0.175	-0.03	(0.03)	p=0.333
Trait Anxiety						
1st quartile	Referent	-	-	Referent	-	-
2nd quartile	0.01	(0.84)	p=0.995	0.33	(0.83)	p=0.687
3rd quartile	0.09	(0.83)	p=0.919	0.53	(0.82)	p=0.523
4th quartile	-0.92	(0.86)	p=0.288	-0.56	(0.85)	p=0.511

^aAdjusted for age and pre-pregnancy BMI

Table 3.

Early Pregnancy Perceived Psychosocial Stress and Anxiety and Total GWG: Proyecto Buena Salud, 2006–2012.

	Unadjusted			Adjusted ^a		
	β	(SE)	p-value	β	(SE)	p-value
Perceived Psychosocial Stress	−0.16	(0.08)	p=0.052	−0.19	(0.05)	p=0.019
Perceived Psychosocial Stress						
1st quartile	Referent	-	-	Referent	-	-
2nd quartile	−1.05	(1.62)	p=0.517	−1.36	(1.55)	p=0.382
3rd quartile	−0.93	(1.57)	p=0.554	−0.95	(1.51)	p=0.532
4th quartile	−3.54	(1.60)	p=0.027	−3.89	(1.54)	p=0.012
Trait Anxiety	−0.17	(0.05)	p=0.002	−0.17	(0.05)	p=0.002
Trait Anxiety						
1st quartile	Referent	-	-	Referent	-	-
2nd quartile	−1.31	(1.57)	p=0.404	−2.10	(1.52)	p=0.167
3rd quartile	−1.11	(1.54)	p=0.473	−1.02	(1.49)	p=0.491
4th quartile	−4.33	(1.60)	p=0.007	−4.37	(1.54)	p=0.005

^a Adjusted for age and pre-pregnancy BMI

Table 4.

Pregnancy Perceived Psychosocial Stress and Anxiety and Rate of GWG: Proyecto Buena Salud, 2006–2012.

	Unadjusted			Adjusted ^a		
	β	(SE)	p-value	β	(SE)	p-value
Perceived Psychosocial Stress	−0.002	(0.003)	p=0.432	−0.004	(0.002)	p=0.106
Perceived Psychosocial Stress						
1st quartile	Referent	-	-	Referent	-	-
2nd quartile	0.013	(0.050)	p=0.792	−0.003	(0.047)	p=0.941
3rd quartile	0.018	(0.049)	p=0.718	0.006	(0.046)	p=0.904
4th quartile	−0.066	(0.051)	p=0.194	−0.088	(0.047)	p=0.064
Trait Anxiety	−0.004	(0.002)	p=0.036	−0.004	(0.002)	p=0.015
Trait Anxiety						
1st quartile	Referent	-	-	Referent	-	-
2nd quartile	−0.032	(0.049)	p=0.516	−0.062	(0.046)	p=0.174
3rd quartile	0.033	(0.049)	p=0.506	0.025	(0.046)	p=0.590
4th quartile	−0.108	(0.050)	p=0.031	−0.114	(0.047)	p=0.016

^a Adjusted for age and pre-pregnancy BMI

Table 5.

Mid/Late Pregnancy Perceived Psychosocial Stress and Anxiety and Total GWG: Proyecto Buena Salud, 2006–2012.

	Unadjusted			Adjusted ^a		
	β	(SE)	p-value	β	(SE)	p-value
Perceived Psychosocial Stress	-0.16	(0.07)	p=0.019	-0.17	(0.07)	p=0.011
Perceived Psychosocial Stress						
1st quartile	Referent	-	-	Referent	-	-
2nd quartile	-1.83	(1.37)	p=0.182	-2.09	(1.32)	p=0.115
3rd quartile	-2.69	(1.47)	p=0.068	-2.93	(1.42)	p=0.040
4th quartile	-3.73	(1.44)	p=0.010	-3.84	(1.39)	p=0.006
State Anxiety	-0.09	(0.05)	p=0.051	-0.09	(0.05)	p=0.037
State Anxiety						
1st quartile	Referent	-	-	Referent	-	-
2nd quartile	-2.69	(1.40)	p=0.056	-2.97	(1.35)	p=0.029
3rd quartile	-1.10	(1.47)	p=0.455	-1.54	(1.42)	p=0.278
4th quartile	-3.42	(1.42)	p=0.017	-3.51	(1.38)	p=0.011

^a Adjusted for age and pre-pregnancy BMI

Table 6.

Mid/Late Pregnancy Perceived Psychosocial Stress and Anxiety and Rate of GWG in the 2nd and 3rd Trimesters: Proyecto Buena Salud, 2006–2012.

	Unadjusted			Adjusted ^a		
	β	(SE)	p-value	β	(SE)	p-value
Perceived Psychosocial Stress	−0.004	(0.002)	p=0.064	−0.005	(0.002)	p=0.013
Perceived Psychosocial Stress						
1st quartile	Referent	-	-	Referent	-	-
2nd quartile	−0.035	(0.045)	p=0.429	−0.047	(0.042)	p=0.265
3rd quartile	−0.018	(0.048)	p=0.701	−0.045	(0.045)	p=0.321
4th quartile	−0.104	(0.046)	p=0.026	−0.117	(0.044)	p=0.008
State Anxiety	−0.003	(0.001)	p=0.040	−0.003	(0.001)	p=0.027
State Anxiety						
1st quartile	Referent	-	-	Referent	-	-
2nd quartile	−0.040	(0.045)	p=0.371	−0.047	(0.042)	p=0.264
3rd quartile	0.013	(0.046)	p=0.773	−0.009	(0.044)	p=0.829
4th quartile	−0.120	(0.0452)	p=0.008	−0.116	(0.043)	p=0.007

^aAdjusted for age and pre-pregnancy BMI