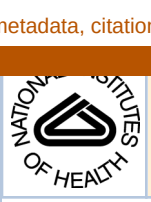

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Correlates of Stress among Pregnant Hispanic Women

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Abstract

Objectives—Prenatal psychosocial stress has been associated with adverse pregnancy outcomes, even after controlling for known risk factors. This paper aims to evaluate correlates of high perceived stress among Hispanic women, a group with elevated rates of stress during pregnancy.

Methods—We conducted this analysis among 1426 pregnant Hispanic women using data from Proyecto Buena Salud, a prospective cohort study conducted in Western Massachusetts. Cohen's Perceived Stress Scale (PSS-14) validated in English and Spanish was administered in early (mean=12.4 wks gestation), mid (mean=21.3 wks gestation) and late (mean=30.8 wks gestation) pregnancy at which time bilingual interviewers collected data on socio-demographic, acculturation, behavioral, and psychosocial factors. High perceived stress was defined as a PSS score>30.

Results—Young maternal age (odds ratio (OR) =0.6; 95% confidence interval (CI) 0.4-0.9 for <19 vs. 19-23yrs), pre-pregnancy consumption of alcohol (OR=2.2; 95% CI 1.4-3.5 for >12 drinks/mo. vs. none) and smoking (OR=2.2; 95% CI 1.3-3.7 for >10 cigarettes/day vs. none) were associated with high perceived stress during early pregnancy. Furthermore, higher annual household income (OR=0.4; 95% CI 0.1-0.9 for >$30,000 vs. <$15,000), greater number of adults in the household (OR=1.8; 95% CI 1.1-3.0 for ≥3 vs. 1) and language preference (OR=0.6; 95% CI 0.4-0.9 for Spanish vs. English) were associated with high stress during mid-pregnancy. Likewise, annual household income was inversely associated with high stress during late pregnancy.

Conclusion—Our results have important implications for incorporation of routine screening for psychosocial stress during prenatal visits and implementation of psychosocial counseling services for women at high risk.

Keywords

perceived stress; correlates; pregnancy; Hispanic

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INTRODUCTION

Considerable evidence supports a modest adverse effect of prenatal psychosocial stress on fetal and infant birth outcomes including preterm birth, low birth weight, intrauterine growth restriction, behavioral and mental health problems, and fetal morbidity (1-6). Biomedical risk factors such as medical and obstetric history, lifestyle and behavioral factors, and socio-demographic characteristics account for 50 percent or less of the incidence of low birth weight, preterm birth, and their postnatal sequelae (2, 7, 8). Therefore, a significant portion of adverse pregnancy outcomes may be attributable to psychosocial factors, even after controlling for known risk factors (2, 5).

Prenatal maternal stress is common, yet the prevalence among pregnant women is unclear (9). Variability in measures used to capture psychosocial stress has resulted in differing rates across studies. For example, 12% of women from the Canadian Maternity Experiences Survey (MES) experienced high levels of perceived stress in the year prior to the birth of their baby in response to one overall question about the amount of stress in their lives (10). In a cross-sectional study among predominantly non-Hispanic white prenatal care patients in Seattle, 78% of participants reported low-moderate psychosocial stress and 6% reported high stress as measured by the Prenatal Psychosocial Profile Stress Scale (9). Laraia *et al.* found higher mean perceived stress scores using Cohen's Perceived Stress Scale (PSS-14) in early pregnancy among 606 participants with incomes ≤400% of the poverty line (22.3±8.14, range of 2 to 47) (11), as compared to those reported by prior studies among non-pregnant women (20.2±7.8; 16.14±7.56) (12, 13).

Because maternal stress is a potentially modifiable risk factor for adverse perinatal outcomes such as preterm birth and low birth weight (1, 3, 4, 14) and fetal and infant behavior and development (1, 2, 6, 14, 15), evaluation of correlates of stress during pregnancy may be useful in identifying high risk women (16). However, few studies have specifically explored factors that contribute to or coexist with psychosocial stress during pregnancy (9, 10, 17). In these studies, correlates of high stress included demographic characteristics (i.e., younger age, higher income, lower educational status, being unmarried, unemployment), psychosocial variables (unhappy feelings about being pregnant, current and previous history of depression, low perceived psychosocial support during pregnancy), behavioral factors (smoking, alcohol, and drug use), obstetric history (previous miscarriage, greater pregnancy-related complications), and domestic violence (9, 10, 17). These studies were limited by varying measures of stress, cross-sectional design, and small sample sizes. In addition, correlates of stress were assessed at only one time point in pregnancy precluding the evaluation of change in stress during pregnancy.

Women of low socioeconomic status and racial/ethnic minorities such as Hispanics may experience higher levels of psychosocial stress during pregnancy (18, 19). In a previous paper in our study population, pregnant Hispanic Caribbean Islanders reported higher mean levels of psychosocial stress, as measured by the PSS-14, of 26.9±7.1 (range 5–48) (20) than those reported previously among predominantly non-Hispanic white pregnant women (11). Hispanics from the Caribbean islands (i.e., Puerto Ricans and Dominicans) constitute the largest Hispanic subgroup in the northeast U.S., the second largest group of Hispanics in the U.S., and the fastest growing subgroup (21, 22). As compared to other Hispanics, Puerto Ricans and Dominicans experience the greatest health disparities, least education, lowest incomes, and exhibit more adverse behaviors such as poor nutrition (23, 24). Thus pregnant Hispanic women represent a high risk group for increased levels of psychosocial stress and its associated perinatal complications. These findings have important implications because Hispanics have the highest birth and immigration rates of any minority group (18); by 2050

Hispanic women will comprise approximately 24% of the female population in the United States (25). To our knowledge, no studies have examined correlates of high stress among pregnant Hispanic women.

Therefore, we prospectively evaluated correlates of high perceived stress during early, mid and late pregnancy among Hispanic women using data from Proyecto Buena Salud (PBS), a cohort study of Hispanic prenatal care patients in Western Massachusetts.

METHODS

Study Setting

Proyecto Buena Salud was conducted from 2006 to 2011 in the ambulatory obstetrical practices of a large tertiary care facility in Western Massachusetts (20). The overall goal of Proyecto Buena Salud was to examine the relationship between physical activity, psychosocial stress, and risk of gestational diabetes in Hispanic women of Caribbean Island heritage. Bilingual interviewers recruited patients at prenatal care visits early in pregnancy (up to 20 weeks gestation), informed them of the aims and procedures of the study and obtained written informed consent. This study was approved by the Institutional Review Boards of the University of Massachusetts-Amherst and Baystate Health.

At the time of enrollment (mean=12.4 weeks gestation), bilingual interviewers collected information on socio-demographic, acculturation, behavioral, and psychosocial factors. Information on behavioral and psychosocial factors was updated in mid (mean=21.3 weeks gestation) and late (mean=30.8 weeks gestation) pregnancy. Medical factors were abstracted from medical records. Interviews were conducted in Spanish or English (based on patient preference) in order to eliminate potential language or literacy barriers.

Eligibility

Eligibility was restricted to women of Puerto Rican or Dominican Republic (PR/DR) heritage. Exclusion criteria included: 1) current medications that adversely influence glucose tolerance, 2) multiple gestation, 3) history of diagnosis of diabetes, hypertension, heart disease or chronic renal disease, and 4) age less than 16 years or over 40 years. A total of 1620 prenatal care patients were enrolled in Proyecto Buena Salud. For the current analysis, we excluded participants missing information on psychosocial stress at all 3 time points (n=194) for a total of 1,426 women in the final sample.

Perceived Psychosocial Stress

Perceived stress was measured at each interview using the PSS-14 which includes 14 items designed to address a person's sense of control over daily life demands (26). Each item was rated on a 5-point scale ranging from never (0) to almost always (4). Positively worded items were reverse scored, and the ratings were summed. Scores ranged from 0 to 56, with higher scores indicating more perceived stress. Internal consistency of the PSS as assessed by Cronbach's alpha was 0.85 in three samples tested by Cohen *et al* and 0.78 in a general population study (26-28). Correlations were also observed with indices of depressive symptomatology (0.65 and 0.76). The European Spanish version of the PSS-14 demonstrated adequate reliability (internal consistency, alpha=0.81, and test-retest, r=0.73), validity (concurrent), and sensitivity (28).

Sociodemographic Factors

At the time of enrollment, interviewers collected information on age, education, annual household income, marital status, living situation (i.e., with a partner/spouse), and number of children under 18 years and adults in the household.

Acculturation Factors

At the time of enrollment, interviewers collected information on language preference for speaking/reading (English, Spanish), generation in the Continental U.S., and administered the 10-item Psychological Acculturation Scale (PAS) which measures an individual's sense of psychological attachment to and belonging within Anglo-American and Latino/Hispanic cultures. Item responses are scored on a 5-point Likert scale ranging from 1 (only Hispanic/Latino) to 5 (only Anglo/American) (29). We defined scores <3 as low acculturation and scores ≥3 as high acculturation. PAS scores have been correlated with migration history and patterns of Spanish and English language use in a sample of Puerto Rican females; correlations between PAS scores from the Spanish and English versions (r=0.94) suggest a high degree of cross-language measurement equivalence (29).

Behavioral Factors

Behavioral factors were assessed at each interview using questions designed by the Pregnancy Risk Assessment Monitoring System (PRAMS) and included alcohol consumption and cigarette smoking (30).

Physical activity during pre-pregnancy (1 year prior) and early pregnancy was assessed at the time of enrollment and updated during the mid- and late pregnancy interviews using the Pregnancy Physical Activity Questionnaire (PPAQ), a semi-quantitative questionnaire that evaluates participation in four domains of activities: household/caregiving, occupational, sports/exercise, and transportation (31).

Psychosocial Factors

Trait anxiety was assessed at each interview using the Spielberger State-Trait Anxiety Inventory (STAI) which measures relatively stable individual differences in anxiety proneness and contains 20 statements about how the respondent generally feels (32). The instrument has been previously used in studies during the prenatal period (33). The Spanish version of the STAI was validated and adapted by TEA Editions (34). Depressive symptoms were assessed at each interview using the 10-item Edinburgh Postnatal Depression Scale (EPDS) available in English and Spanish (35, 36). Women with a score ≥13 were considered to have probable minor depression or a score ≥15 probable major depression (37-39). The EPDS has been validated as a depression screening tool in pregnant and postpartum Hispanic women and has a sensitivity of 90%–100% and a specificity of 78%–88% for the identification of major and minor depression (36, 40).

Medical History Factors

After delivery, medical records were abstracted for medical and obstetrical history, including pre-pregnancy body mass index (BMI), parity, clinical characteristics of the current pregnancy, and reproductive history.

Data Analysis

Repeated-measures analyses of variances (ANOVAs) were computed to examine time differences in PSS scores within each stage of pregnancy. In light of prior literature suggesting a threshold effect of psychosocial factors on adverse maternal and fetal outcomes (41), we evaluated correlates of high perceived stress. Because there are no published cutpoints for high vs. moderate or low stress for the PSS, we compared women in the top quartile with those in lower quartiles of stress. Specifically, we chose a cut-off of PSS>30 to define high stress, based on the average of the 75th percentile scores (early=29, mid=30, and late=31) at each stage in pregnancy. Distributions of socio-demographic, acculturation, behavioral, medical and psychosocial factors were examined according to high and low

stress categories using Chi Square Tests or Fisher's Exact Test, in cases of small cell size. Multivariable logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (CI) for high perceived stress during each stage of pregnancy in relation to potential correlates.

The basic model included correlates of high stress observed in prior literature (age, education, income, living situation and number of children in the household). Demographic, acculturation, behavioral and medical factors that were associated with high stress in unadjusted models at $p<0.20$ were added to the basic model, one at a time to evaluate the potential confounding effect on variables in the naïve model. Variables with a p-value <0.05 from likelihood ratio tests or that caused a greater than 10 percent change in the coefficient estimates for initial variables in the basic model were retained in subsequent models. We excluded trait anxiety and depression from the regression models as these factors may reflect aspects of stress and were highly correlated with perceived stress ($r=0.66$-0.81, $p<0.01$) (42). A missing indicator category was created for all variables that were missing information for more than 25 observations, aside from age, education, insurance, living situation, number of adults in the household, language preference and pre-pregnancy smoking and alcohol consumption. Tests for linear trend were calculated by modeling the ordinal variables as continuous variables.

Finally, to account for the correlation between repeated measures on the same subject, we used the generalized linear mixed effects model (Proc Glimmix) to model the effect of all correlates on stress (high vs. low) across pregnancy. This procedure allows specification of a mixed logistic regression model and handling of unbalanced data with correlated outcome and missing data. In all mixed models, the intercept was allowed to vary between subjects, and the regression slopes were assumed to be fixed effects. Statistical analysis was conducted using SAS 9.2 software by SAS Institute Inc. (SAS Campus Drive, Cary, North Carolina).

RESULTS

A total of 1,426 women had information on perceived stress at one or more time points during pregnancy as follows: early (n=979), mid (n=792), and late (n=751) pregnancy. Mean (Standard Deviation) PSS scores decreased from 26.2 (7.1) during early pregnancy to 25.2 (7.5) and 23.4 (7.7) during mid- and late pregnancy, respectively ($p<.0001$). Overall, participants were young, with low levels of education, and income (Table 1). In bivariate analyses, younger age and higher generation in the US were inversely associated with early pregnancy stress while pre-pregnancy alcohol consumption, pre- and early pregnancy smoking, depression, and trait anxiety were positively associated with early pregnancy stress (Table 1).

Associations in Early Pregnancy

Women less than 19 years of age were 50 percent less likely to have high levels of perceived stress during early pregnancy compared to women between 19 and 23 years (OR=0.5; 95% CI: 0.4,0.8, $p_{trend}=0.48$) (Table 2, Model A). After further adjustment for language preference (Model B), women who preferred Spanish had a 30 percent lower odds of high perceived stress compared to those who preferred English (95% CI: 0.5, 1.0). With further adjustment for generation and pre-pregnancy alcohol consumption (Model D), participants with annual household income greater than $30,000 were 60 percent less likely to have high stress as compared to those with income of $30,000 or less (95% CI: 0.2, 0.9, $p_{trend}=0.06$) (Model D). Participants reporting consumption of greater than 5 to 12 drinks and over 12 drinks per month during pre-pregnancy had 1.8 (95% CI: 1.1, 2.9) and 2.4 times (95% CI: 1.6, 3.6, $p_{trend}<0.0001$) higher odds of high stress as compared to those with no alcohol

consumption in pre-pregnancy. In the final model (Model E) which adjusted for education, income, living situation, children in the household, language preference and generation, younger maternal age, pre-pregnancy smoking and alcohol consumption continued to be associated with perceived stress.

Associations in Mid-Pregnancy

Unlike early pregnancy, younger maternal age was not associated with high perceived stress during mid-pregnancy (Table 3, Model A). Women with annual household income between $15,000 and $30,000 were 60 percent less likely to report high stress as compared to those with income below $15,000 (95% CI: 0.2, 0.8, $p_{trend}<0.01$). After adjustment for adults in the household (Model B), participants who reported living with three or more adults had an 80 percent increased odds of mid-pregnancy stress when compared with one-adult households (95% CI: 1.1, 3.0, $p_{trend}=0.01$). After further adjustment for language preference (Model C), women with annual household income of >$15,000 to $30,000 (OR=0.4, 95% CI: 0.2, 0.7) and >$30,000 (OR=0.4; 95% CI: 0.1, 0.9, $p_{trend}<0.01$) were less likely to report high stress compared to women with income ≤$15,000. Finally participants who preferred Spanish had a 40 percent reduced odds of high stress during mid-pregnancy as compared to those who preferred English as a language (95% CI: 0.4, 0.9).

Associations in Late Pregnancy

Annual household income >$15,000 to $30,000 was the only variable associated with high late pregnancy stress, when compared with income ≤$15,000 (OR=0.4; 95% CI: 0.2, 0.8, $p_{trend}=0.16$) (Table 4, Model A). No other sociodemographic, acculturation, and behavioral factors were significant correlates of high stress during late pregnancy.

Overall Pregnancy

Results from the random intercept logistic regression models were similar to those obtained within each stage of pregnancy (Table 5). In the initial model (model A), age less than 19 years (OR=0.6; 95% CI: 0.4, 0.8), college education (OR=0.6; 95% CI: 0.4, 0.9), annual household income >$15,000 to $30,000 (OR=0.5; 95% CI: 0.4, 0.8), and late stage of pregnancy (OR=0.5; 95% CI: 0.4, 0.7) were inversely associated with reporting stress over time. After adding generation (Model B), participants with parents born in PR/DR were 40 percent more likely to report high stress as compared to those who themselves were born in PR/DR (95% CI: 1.1, 1.7). With further adjustment for pre-pregnancy alcohol consumption (Model C), women who reported consumption of over 12 drinks per month were 70 percent more likely to report high stress across pregnancy as compared to those with no alcohol consumption in pre-pregnancy (95% CI: 1.2, 2.5). In the final model which further adjusted for pre-pregnancy smoking (model D), age, income, and stage of pregnancy were significantly inversely associated with high stress across pregnancy; whereas pre-pregnancy alcohol consumption and smoking (OR= 1.9; 95% CI: 1.2, 2.8) were positively associated with high stress.

Finally, women missing information on psychosocial stress did not differ from those not missing stress with regards to socio-demographic, acculturation, behavioral, and psychosocial factors aside from insurance type (14.9% vs. 7.3% with private insurance, p=0.01).

DISCUSSION

In this prospective study of pregnant Hispanic women, we found that stress levels significantly decreased over the course of pregnancy. Increasing age, pre-pregnancy alcohol, and smoking were positively associated with high early pregnancy stress. Number of adults

in the household was positively associated with high mid-pregnancy stress; while increasing household income and Spanish language preference were inversely associated with high mid-pregnancy stress. Likewise, higher annual household income was inversely associated with high late pregnancy stress.

Our findings of a significant decrease in stress from early to mid- to late pregnancy are consistent with other studies that measured psychosocial stress at different time points (43-45), however one prior study conducted among predominantly non-Hispanic white women in Canada found that stress measures followed a U-shaped pattern with the lowest scores seen in the second trimester (46).

There are both similarities and differences between our findings and those of the prior literature. Stancil *et al.* found that higher perceived stress measured by the PSS-10 was statistically significantly associated with younger age, higher income, and lower educational status in a sample of 94 African-American pregnant women (17). Similarly, we found lower education levels to be associated with higher perceived stress, while in contrast we found that younger maternal age and higher income were associated with low perceived stress. Kingston *et al.*, in a sample of Canadian pregnant women (10), found that history of depression, parity, and prior history of adverse pregnancy outcomes were positively related to stress. Our findings were similar for depression, but in contrast, we found that maternal age, annual household income and number of adults in the household were significantly associated with perceived stress while parity and prior history of adverse pregnancy outcomes were not significantly associated. Our results concur with a longitudinal study by Woods *et al.* conducted among predominantly non-Hispanic white women in Seattle, who found that marital status, employment, education, race, age, and history of pregnancy complication were not significantly associated with high psychosocial stress as measured by the Prenatal Psychosocial Profile Stress scale (9). Our finding that English language preference was positively associated with high stress may reflect higher acculturation status, which has been found to be associated with increased stressful life experiences and risk behaviors (47).

Differences in findings between our study and prior literature may be due to the differences in study populations, the timing of assessment during pregnancy, as well as the measurement tools used to assess stress. Only Stancil *et al.* used the PSS-10 to measure stress, and their findings in African American women were similar to ours (17).

Our study had several limitations. We relied on self-reported measures of perceived stress. Differences in stress levels among participants may reflect real differences in stress or cultural differences in the conceptualization and expression of stress. Some studies have suggested higher stigma regarding mental illness in Hispanics as compared to non-Hispanic whites and therefore greater reluctance to disclose such problems outside of the family (48, 49). Self-reported depressive symptoms in Hispanic women have also been found to differ by acculturation (50). However, the PSS has been validated against other instruments that measure similar constructs including average weekly stress, number of life events, distress and anxiety measures with adequate sensitivity to detect populations under different levels of stress (13, 28).

Additionally, our use of the top quartile to reflect high perceived stress may have led to misclassification. However, prior research has suggested a threshold effect for stress on preterm delivery with increased risk limited to women with scores in the highest quartile (41). Finally, due to the prospective nature of our study, such misclassification would tend to bias our results toward the null.

The present analysis was conducted among participants with complete stress information in early, mid, and late pregnancy. Those missing data did not differ significantly from those not missing data on all factors with the exception of insurance status. To the extent that insurance status is associated with stress, such missing data could have led to bias.

Residual confounding is a possibility due to errors in measurement or incorrect categorization of correlates. However, items on the questionnaire were adapted from previously validated scales and exposure categories included fairly standard groupings, thus minimizing this concern. We did not have information on history of mental health prior to pregnancy; however these measures would likely be highly correlated with pregnancy mental health (10, 37, 51). Finally, perceived stress levels and their correlates may differ according to race/ethnicity and socioeconomic status, thus limiting the generalizability of our findings.

In summary, in this prospective cohort of pregnant Hispanic women, maternal age, annual household income, pre-pregnancy alcohol and cigarette consumption were correlates of high perceived stress across pregnancy. Our findings that differing factors affected perceived stress during early, mid- and late pregnancy, underscores the importance of adjusting for these factors in analyses of stress and health outcomes. Our results have important implications in incorporation of routine screening for psychosocial stress during prenatal visits and implementation of psychosocial counseling services for women at high risk of adverse perinatal outcomes.

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Table 1

Baseline participant characteristics by perceived stress in early pregnancy, Proyecto Buena Salud, 2006-2011 Total Sample

	Total Sample		PSS ≤ 30	PSS > 30	P-value [e]
	N[d]	%	%	%	
	979	**100.0**	**73.1**	**26.9**	
Demographic Factors					
Age					
Less than 19	211	21.6	23.6	16.0	0.01
19-23 years	417	42.6	40.9	47.2	
24-29 years	236	24.1	22.6	28.1	
30 years and above	115	11.8	12.9	8.8	
Educational status					
<High school	460	47.5	46.5	50.0	0.29
High school graduate	313	32.3	32.0	33.1	
Some college/graduate	196	20.2	21.4	16.9	
Annual Household Income					
<$15,000	283	28.9	28.2	30.8	0.09
>$15,000-$30,000	147	15.0	15.8	12.9	
>$30,000	74	7.6	8.7	4.6	
Don't know/Refused/Missing	475	48.5	47.4	51.7	
Health Insurance					
Public	909	93.5	93.2	94.3	0.56
Private	63	6.5	6.8	5.7	
Marital status					
Single/divorced/separated/widowed	840	85.8	85.5	86.7	0.39
Married	103	10.5	11.2	8.8	
Refused/Missing	36	3.68	3.4	4.6	
Live with spouse/partner					
No	473	49.1	49.6	47.9	0.64
Yes	490	50.9	50.4	52.1	
Children (<18 yrs) in household[a]					

	Total Sample		PSS ≤ 30	PSS > 30	P-value [e]
	N[d]	%	%	%	
	979	**100.0**	**73.1**	**26.9**	
0	181	18.5	17.7	20.5	0.89
1	333	34.0	34.1	33.8	
2	237	24.2	24.6	23.2	
3+	192	19.6	19.8	19.0	
Adults (>18 yrs) in household[a]					
1	234	24.4	24.9	22.9	0.44
2	458	47.7	48.2	46.1	
3+	269	28.0	26.9	31.0	
Acculturation Factors					
Language preference for speaking/reading					
English	750	76.6	75.4	79.9	0.15
Spanish	229	23.4	24.6	20.2	
Acculturation Status[b]					
<3	746	76.2	77.5	72.6	0.25
≥3	192	19.6	18.7	22.1	
Generation in the continental US[c]					
First generation	446	45.6	46.8	42.2	<.01
Second generation	446	45.6	42.7	53.2	
Third generation	54	5.5	6.6	2.7	
Behavioral Factors					
Pre-pregnancy alcohol consumption					
None	553	57.3	60.9	47.3	<.0001
0 to 5 drinks per month	172	17.8	18.1	17.1	
Over 5 to 12 drinks per month	107	11.1	10.0	14.0	
Over 12 drinks per month	134	13.9	11.0	21.7	
Early pregnancy alcohol consumption					
None 929	94.9	94.7	95.4	0.89	
Yes	24	2.5	2.5	2.3	

	Total Sample		PSS ≤ 30	PSS > 30	P-value [e]
	N[d]	%	%	%	
	979	**100.0**	**73.1**	**26.9**	
Pre-pregnancy cigarette smoking					
None	640	66.3	69.8	56.6	<.0001
≤ 10 cigarettes per day	242	25.1	23.9	28.3	
> 10 cigarettes per day	84	8.7	6.4	15.1	
Early pregnancy cigarette smoking					
None	815	83.3	85.3	77.6	0.01f
≤ 10 cigarettes per day	124	12.7	10.9	17.5	
> 10 cigarettes per day	13	1.3	1.0	2.3	
Total physical activity during early pregnancy					
Quartile1	229	23.4	23.7	22.4	0.54
Quartile2	229	23.4	23.7	22.4	
Quartile3	229	23.4	24.2	21.3	
Quartile4	228	23.3	21.9	27.0	
Medical History Factors					
BMI					
Less than 18.5	45	4.6	4.1	6.1	0.44
18.5 to under 25	427	43.6	43.7	43.4	
25 to under 30	196	20.0	21.1	17.1	
30 or above	196	20.0	19.8	20.5	
Parity					
0	365	37.3	38.1	35.0	0.36
1	267	27.3	28.1	25.1	
≥2	230	23.5	22.5	26.2	
History of adverse pregnancy outcome					
No	699	71.4	73.2	66.5	0.08
Yes	106	10.8	10.6	11.4	
Psychosocial Factors					
Edinburgh Depression Scale					

	Total Sample		PSS ≤ 30	PSS > 30	P-value [e]
	N[d]	%	%	%	
	979	**100.0**	**73.1**	**26.9**	
At risk for depressive illness					
No	678	69.3	81.7	35.4	<.0001
Yes	272	27.8	15.5	61.2	
Probable depression					
No	780	79.7	89.3	53.6	<.0001
Yes	170	17.4	8.0	43.0	
Trait Anxiety					
Quartile1	268	27.4	36.6	2.3	<.0001
Quartile2	233	23.8	29.2	9.1	
Quartile3	236	24.1	22.8	27.8	
Quartile4	216	22.1	8.9	57.8	

[a] Including the participant as appropriate: if <18 yrs, included as a child; if >18 yrs, included as an adult.

[b] Acculturation is measured by the Psychological Acculturation Scale and ranges from 1-5; score <3=low acculturation

[c] First generation: born in Puerto Rico/Dominican Republic (PR/DR) or parent born in PR/DR; Second generation: born in US but parents born in PR/DR; Third generation: born in US, parents born in US, grandparents born in PR/DR.

[d] Numbers may not total to 979 due to missing data.

[e] P-values from Chi square tests for categorical variables

[f] P-values from Fishers test if expected cell counts less than 5

Table 2

Odds ratios (95% confidence intervals) for high perceived stress during early pregnancy (n=979), Proyecto Buena Salud, 2006-2011

	Model A		Model B		Model C		Model D		Model E	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Demographic factors										
Age										
<19	0.5	(0.4, 0.8)	0.5	(0.4, 0.8)	0.5	(0.3, 0.8)	0.6	(0.4, 0.9)	0.6	(0.4, 0.9)
19-23	1.0	referent	1.0	referent	1.0	referent	1.0	referent	1.0	referent
24-29	1.2	(0.9, 1.8)	1.3	(0.9, 1.9)	1.3	(0.9, 1.9)	1.3	(0.9, 1.9)	1.2	(0.8, 1.8)
≥30	0.7	(0.4, 1.2)	0.8	(0.4, 1.3)	0.8	(0.5, 1.3)	0.8	(0.5, 1.4)	0.7	(0.4, 1.3)
Educational status										
<High school	1.0	referent	1.0	referent	1.0	referent	1.0	referent	1.0	referent
High school graduate	0.9	(0.6, 1.3)	0.9	(0.6, 1.3)	0.9	(0.6, 1.3)	0.8	(0.6, 1.2)	0.9	(0.6, 1.2)
Some college/graduate	0.7	(0.4, 1.1)	0.7	(0.4, 1.1)	0.7	(0.5, 1.1)	0.6	(0.4, 1.0)	0.7	(0.4, 1.1)
Annual Household Income										
<$15,000	1.0	referent	1.0	referent	1.0	referent	1.0	referent	1.0	referent
>$15,000-$30,000	0.8	(0.5, 1.3)	0.8	(0.5, 1.2)	0.7	(0.5, 1.2)	0.8	(0.5, 1.2)	0.8	(0.5, 1.2)
>$30,000	0.6	(0.3, 1.1)	0.5	(0.2, 1.0)	0.5	(0.2, 1.0)	0.4	(0.2, 0.9)	0.5	(0.2, 1.0)
Don't know/Refused/Missing	1.1	(0.8, 1.6)	1.1	(0.8, 1.6)	1.1	(0.8, 1.6)	1.2	(0.8, 1.7)	1.2	(0.8, 1.7)
Live with spouse/partner										
No	1.0	referent	1.0	referent	1.0	referent	1.0	referent	1.0	referent
Yes	1.1	(0.8, 1.5)	1.1	(0.8, 1.5)	1.1	(0.8, 1.5)	1.2	(0.8, 1.6)	1.2	(0.9, 1.6)
Children (<18 yrs) in household										
0	1.0	referent	1.0	referent	1.0	referent	1.0	referent	1.0	referent
1	0.8	(0.6, 1.3)	0.9	(0.6, 1.3)	0.8	(0.6, 1.3)	0.9	(0.6, 1.4)	0.9	(0.6, 1.4)
2	0.8	(0.5, 1.2)	0.8	(0.5, 1.3)	0.8	(0.5, 1.3)	0.8	(0.5, 1.3)	0.8	(0.5, 1.3)
3+	0.8	(0.5, 1.3)	0.8	(0.5, 1.4)	0.8	(0.5, 1.4)	0.9	(0.6, 1.5)	0.9	(0.6, 1.5)
Acculturation Factors										
Language preference for										
English			1.0	referent	1.0	referent	1.0	referent	1.0	referent
Spanish			0.7	(0.5, 1.0)	0.7	(0.5, 1.1)	0.8	(0.5, 1.1)	0.8	(0.5. 1.2)
Generation in the continental US										

	Model A		Model B		Model C		Model D		Model E	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Born in PR/DR					1.0	referent	1.0	referent	1.0	referent
Parent born in PR/DR					1.4	(1.0, 1.9)	1.3	(0.9, 1.8)	1.3	(0.9, 1.8)
Grandparent born in PR/DR					0.4	(0.2, 1.0)	0.4	(0.2, 1.0)	0.4	(0.2, 1.1)
Behavioral Factors										
Pre-pregnancy alcohol consumption										
None							1.0	referent	1.0	referent
0 to 5 drinks per month							1.2	(0.8, 1.9)	1.2	(0.8, 1.8)
Over 5 to 12 drinks per month							1.8	(1.1, 2.9)	1.7	(1.1, 2.8)
Over 12 drinks per month							2.4	(1.6, 3.6)	2.2	(1.4, 3.5)
Pre-pregnancy cigarette smoking										
None									1.0	referent
≤ 10 cigarettes per day									1.0	(0.7, 1.5)
> 10 cigarettes per day									2.2	(1.3, 3.7)
c-statistic	0.6		0.6		0.6		0.7		0.7	

Odds ratios (OR)s and 95% Confidence Intervals (CI)s calculated from multivariable logistic regression models.

Each variable was adjusted for all other variables in the model.

Model A = age, education, income, living with spouse/partner, and number of children in the household

Model B = Model A + language preference for speaking/reading

Model C = Model B + generation in the U.S.

Model D = Model C + pre-pregnancy alcohol consumption

Model E = Model D + pre-pregnancy cigarette smoking

Table 3

Odds ratios (95% confidence intervals) for high perceived stress during mid-pregnancy (n=792), Proyecto Buena Salud, 2006-2011

	Model A		Model B		Model C	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Demographic factors						
Age						
<19	0.7	(0.4, 1.1)	0.7	(0.4, 1.1)	0.7	(0.4, 1.1)
19-23	1.0	referent	1.0	referent	1.0	referent
24-29	0.7	(0.4, 1.1)	0.8	(0.5, 1.2)	0.8	(0.5, 1.3)
≥30	0.9	(0.5, 1.6)	1.0	(0.6, 1.9)	1.2	(0.6, 2.1)
Educational status						
<High school	1.0	referent	1.0	referent	1.0	referent
High school graduate	0.9	(0.6, 1.4)	0.9	(0.6, 1.4)	1.0	(0.7, 1.4)
Some college/graduate	0.6	(0.4, 1.1)	0.6	(0.4, 1.0)	0.6	(0.4, 1.1)
Annual Household Income						
<$15,000	1.0	referent	1.0	referent	1.0	referent
>$15,000-$30,000	0.4	(0.2, 0.8)	0.4	(0.2, 0.8)	0.4	(0.2, 0.7)
>$30,000	0.4	(0.2, 1.1)	0.4	(0.2, 1.0)	0.4	(0.1, 0.9)
Don't know/Refused/Missing	0.7	(0.5, 1.0)	0.6	(0.4, 1.0)	0.7	(0.5, 1.0)
Live with spouse/partner						
No	1.0	referent	1.0	referent	1.0	referent
Yes	0.9	(0.6, 1.3)	0.8	(0.6, 1.2)	0.8	(0.6, 1.3)
Children (<18 yrs) in household						
0	1.0	referent	1.0	referent	1.0	referent
1	0.8	(0.5, 1.2)	0.8	(0.5, 1.2)	0.8	(0.5, 1.3)
2	0.8	(0.5, 1.3)	0.8	(0.5, 1.3)	0.8	(0.5, 1.3)
3+	1.3	(0.7, 2.2)	1.2	(0.7, 2.1)	1.3	(0.7, 2.2)
Adults (>18 yrs) in household						
1			1.0	referent	1.0	referent
2			1.2	(0.7, 1.9)	1.1	(0.7, 1.9)
≥3			1.8	(1.1, 3.0)	1.8	(1.1, 3.0)
Acculturation Factors						

	Model A		Model B		Model C	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Language preference for						
English					1.0	referent
Spanish					0.6	(0.4, 0.9)
c-statistic	0.6		0.7		0.7	

Odds ratios (OR)s and 95% Confidence Intervals (CI)s calculated from multivariable logistic regression models.

Each variable was adjusted for all other variables in the model.

Model A = age, education, income, living with spouse/partner, and number of children in the household

Model B = Model A + number of adults in the household

Model C = Model B + language preference for speaking/reading

Table 4

Odds ratios (95% confidence intervals) for high perceived stress during late pregnancy (n=751), Proyecto Buena Salud, 2006-2011

	Model A		Model B	
	OR	**95% CI**	**OR**	**95% CI**
Demographic factors				
Age				
<19	0.6	(0.3, 1.0)	0.6	(0.3, 1.1)
19-23	1.0	referent	1.0	referent
24-29	1.2	(0.8, 2.0)	1.2	(0.8, 2.0)
≥30	0.5	(0.2, 1.2)	0.5	(0.2, 1.2)
Educational status				
<High school	1.0	referent	1.0	referent
High school graduate	0.9	(0.6, 1.4)	0.9	(0.6, 1.4)
Some college/graduate	0.5	(0.3, 1.0)	0.5	(0.3, 1.0)
Annual Household Income				
<$15,000	1.0	referent	1.0	referent
>$15,000-$30,000	0.4	(0.2, 0.8)	0.3	(0.2, 0.7)
>$30,000	1.0	(0.4, 2.3)	0.9	(0.4, 2.2)
Don’t know/Refused/Missing	0.8	(0.5, 1.2)	0.8	(0.5, 1.2)
Live with spouse/partner				
No	1.0	referent	1.0	referent
Yes	0.8	(0.5, 1.2)	0.8	(0.5, 1.1)
Children (<18 yrs) in household				
0	1.0	referent	1.0	referent
1	0.8	(0.5, 1.4)	0.8	(0.5, 1.5)
2	0.6	(0.3, 1.2)	0.6	(0.3, 1.2)
3+	1.0	(0.5, 1.9)	1.1	(0.5, 2.1)
Generation in the continental US				
Born in PR/DR			1.0	referent
Parent born in PR/DR			1.2	(0.8, 1.8)
Grandparent born in PR/DR			0.3	(0.1, 1.2)
c-statistic	0.6		0.7	

Odds ratios (OR)s and 95% Confidence Intervals (CI)s calculated from multivariable logistic regression models.

Each variable was adjusted for all other variables in the model.

Model A - age, education, income, living with spouse/partner, and number of children in the household

Model B - Model A + generation in the U.S.

Table 5

Adjusted odds of reporting high perceived stress using generalized linear mixed effects regression Proyecto Buena Salud, 2006-2011

	Model A		Model B		Model C		Model D	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Demographic factors								
Age								
<19	0.6	(0.4, 0.8)	0.6	(0.4, 0.8)	0.6	(0.4, 0.9)	0.6	(0.5, 0.9)
19-23	1.0	referent	1.0	referent	1.0	referent	1.0	referent
24-29	1.0	(0.8, 1.4)	1.0	(0.8, 1.4)	1.0	(0.8, 1.4)	1.0	(0.8, 1.4)
≥30	0.7	(0.5, 1.0)	0.7	(0.5, 1.1)	0.7	(0.5, 1.1)	0.7	(0.4, 1.0)
Educational status								
< High school	1.0	referent	1.0	referent	1.0	referent	1.0	referent
High school graduate	0.9	(0.7, 1.2)	0.9	(0.7, 1.2)	0.9	(0.7, 1.2)	0.9	(0.7, 1.2)
Some college/graduate	0.6	(0.4, 0.9)	0.6	(0.4, 0.9)	0.6	(0.4, 0.9)	0.7	(0.5, 1.0)
Annual Household Income								
<$15,000	1.0	referent	1.0	referent	1.0	referent	1.0	referent
>$15,000-$30,000	0.5	(0.4, 0.8)	0.5	(0.3, 0.8)	0.5	(0.3, 0.8)	0.5	(0.3, 0.8)
>$30,000	0.6	(0.3, 1.0)	0.6	(0.3, 1.0)	0.6	(0.3, 1.0)	0.6	(0.3, 1.1)
Don’t know/Refused/Missing	0.9	(0.7, 1.1)	0.9	(0.7, 1.1)	0.9	(0.7, 1.2)	0.9	(0.7, 1.2)
Live with spouse/partner								
No	1.0	referent	1.0	referent	1.0	referent	1.0	referent
Yes	0.9	(0.7, 1.2)	0.9	(0.7, 1.2)	0.9	(0.7, 1.2)	0.9	(0.7, 1.2)
Children (<18 yrs) in household								
0	1.0	referent	1.0	referent	1.0	referent	1.0	referent
1	0.8	(0.6, 1.1)	0.8	(0.6, 1.1)	0.8	(0.6, 1.2)	0.9	(0.6, 1.2)
2	0.7	(0.5, 1.1)	0.7	(0.5, 1.1)	0.8	(0.5, 1.1)	0.8	(0.5, 1.1)
3+	1.0	(0.7, 1.4)	1.0	(0.7, 1.5)	1.1	(0.7, 1.6)	1.1	(0.7, 1.6)
Stage of pregnancy								
Early	1.0	referent	1.0	referent	1.0	referent	1.0	referent
Mid	0.8	(0.6, 1.0)	0.8	(0.6, 1.0)	0.8	(0.6, 1.0)	0.8	(0.6, 1.0)
Late	0.5	(0.4, 0.7)	0.5	(0.4, 0.6)	0.5	(0.4, 0.7)	0.5	(0.4, 0.7)
Acculturation Factors								

	Model A		Model B		Model C		Model D	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Generation in the continental US								
Born in PR/DR			1.0	referent	1.0	referent	1.0	referent
Parent born in PR/DR			1.4	(1.1, 1.7)	1.3	(1.0, 1.7)	1.3	(1.0, 1.7)
Grandparent born in PR/DR			0.6	(0.3, 1.0)	0.6	(0.3, 1.0)	0.6	(0.3, 1.0)
Behavioral Factors								
Pre-pregnancy alcohol consumption								
None					1.0	referent	1.0	referent
0 to 5 drinks per month					1.0	(0.7, 1.5)	1.0	(0.7, 1.4)
Over 5 to 12 drinks per month					1.5	(1.0, 2.2)	1.4	(1.0, 2.1)
Over 12 drinks per month					1.7	(1.2, 2.5)	1.6	(1.1, 2.3)
Pre-pregnancy cigarette smoking								
None							1.0	referent
≤ 10 cigarettes per day							1.1	(0.8, 1.4)
> 10 cigarettes per day							1.9	(1.2, 2.8)

Odds ratios (OR)s and 95% Confidence Intervals (CI)s calculated from generalized linear mixed effects regression models.

Each variable was adjusted for all other variables in the model.

Model A - age, education, income, living with spouse/partner, number of children in the household, stage of pregnancy

Model B - Model A + generation in the US

Model C - Model B + prepregnancy alcohol consumption

Model D - Model C + prepregnancy smoking