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Original article

# Perceived psychosocial stress and glucose intolerance among pregnant Hispanic women

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## Abstract

**Aim.** – Prior literature suggests a positive association between psychosocial stress and the risk of diabetes in non-pregnant populations, but studies during pregnancy are sparse. We evaluated the relationship between stress and glucose intolerance among 1115 Hispanic (predominantly Puerto Rican) prenatal care patients in Proyecto Buena Salud, a prospective cohort study in Western Massachusetts (2006–2011).

**Methods.** – Cohen's Perceived Stress Scale (PSS-14) was administered in early (mean = 12.3 weeks gestation; range 4.1–18 weeks) and mid- (mean = 21.3 weeks gestation; range 18.1–26 weeks) pregnancy. Participants were classified as having a pregnancy complicated by gestational diabetes mellitus, impaired glucose tolerance, and abnormal glucose tolerance, based on the degree of abnormality on glucose tolerance testing between 24 and 28 weeks of gestation.

**Results.** – The prevalence of gestational diabetes mellitus, impaired glucose tolerance, and abnormal glucose tolerance was 4.1%, 7.2%, and 14.5%, respectively. Absolute levels of early or mid-pregnancy stress were not significantly associated with glucose intolerance. However, participants with an increase in stress from early to mid-pregnancy had a 2.6-fold increased odds of gestational diabetes mellitus (95% confidence intervals: 1.0–6.9) as compared to those with no change or a decrease in stress after adjusting for age and pre-pregnancy body mass index. In addition, every one-point increase in stress scores was associated with a 5.5 mg/dL increase in screening glucose level ( $\beta = 5.5$ ; standard deviation = 2.8;  $P = 0.05$ ), after adjusting for the same variables.

**Conclusion.** – In this population of predominantly Puerto Rican women, stress patterns during pregnancy may influence the risk of glucose intolerance.

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**Keywords:** Epidemiology; Psychosocial stress; Gestational diabetes; Prospective; Hispanic

## 1. Introduction

Gestational diabetes mellitus (GDM), defined as glucose intolerance with first onset during pregnancy is found in approximately 2%–14% of pregnancies, depending on the population studied and the diagnostic test used [1,2]. Exposure to abnormal glucose levels during pregnancy is associated with pregnancy-related complications, including hypertensive

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disorders of pregnancy, preterm delivery, risk of stillbirth, and increased rates of caesarean deliveries [3]. GDM-related metabolic complications in the offspring include impaired glucose tolerance, diabetes, obesity, and metabolic syndrome during early youth and adolescence [4–6]. Furthermore, both GDM and milder glucose intolerance in pregnancy identify women who are at high risk for type 2 diabetes [7,8]. Women diagnosed with GDM have a 17%–63% risk of developing type 2 diabetes and obesity, with a rapid progression to diabetes within the first 5 years after delivery [7,9,10].

Currently recognized risk factors for GDM such as increasing maternal age, obesity, ethnic origin, family history of diabetes, and a previous history of GDM are absent in up to half of affected women [3,11,12]. Psychosocial stress may contribute to the risk of glucose intolerance via the hypothalamic-pituitary-adrenal axis [13,14] by raising the blood concentrations of counter regulatory hormones that inhibit insulin secretion and increase blood glucose level. Given the rising prevalence of glucose abnormalities during pregnancy, recognizing modifiable risk factors such as psychosocial stress is crucial for the prevention of glucose intolerance and its complications for both the mother and child.

Psychosocial factors such as work-related stress, general emotional stress and anxiety, life events, and life stress have been associated with increased risk of glucose abnormalities among non-pregnant populations [15–18]; however, studies during pregnancy are sparse. In a study of stress and GDM among pregnant participants in the Pregnancy Risk Assessment Monitoring System (PRAMS), the authors found that experiencing five or more stressful life events during the 12 months before delivery was associated with a 2.5-fold increased odds of GDM [19] as compared with having no stressful events. Stressful events included legal or financial problems, illness or loss of a loved one, relocation, and relationship issues with spouse/partner. However, the study relied on retrospective recall of prenatal stress during the postpartum period. In addition, measures such as life events scales are limited to a pre-specified list of events and do not take into account perceived stress which may be more relevant to overall stress.

GDM rates among Hispanic women are almost two-fold higher than those reported among non-Hispanic White women [20]. This has notable potential public health implications, as Hispanics are the largest minority group in the United States, with the highest birth and immigration rates of any minority group [21]. Pregnant Hispanic women experience high levels of psychosocial stress [22]. In this population, factors such as increasing maternal age, pre-pregnancy alcohol and cigarette consumption, lower annual household income and English language preference have been associated with high stress during pregnancy, possibly reflecting exposure to greater number of stressors and lower availability of personal resources and social support.

We prospectively evaluated the association between perceived stress in early and mid-pregnancy and the risk of GDM and milder forms of glucose intolerance among pregnant Hispanic women. We also examined the effect of the change in perceived stress during pregnancy on the risk of these

outcomes. We hypothesized that high levels of early and mid-pregnancy stress, as well as increase in stress from early to mid-pregnancy would be positively associated with incidence of glucose intolerance. To our knowledge, this study represents the first to examine this association among pregnant Hispanic women.

## 2. Methods

### 2.1. Study design and study population

Proyecto Buena Salud was conducted from 2006 to 2011 in the ambulatory obstetrical practices of Baystate Medical Center, an integrated health system in Western Massachusetts. Details of the study have been previously published [23]. The overall goals were to examine the relationship between physical activity, psychosocial stress, and risk of GDM in Hispanic women of Caribbean Island heritage (e.g., Puerto Rico or Dominican Republic). Bilingual interviewers recruited patients at prenatal care visits prior 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; range 4.1–18 weeks), bilingual interviewers collected information on socio-demographic, acculturation, behavioral, and psychosocial factors. Information on behavioral and psychosocial factors was updated in mid-pregnancy (mean = 21.3 weeks gestation; range 18.1–26 weeks). Interviews were conducted in Spanish or English (based on patient preference) to eliminate potential language or literacy barriers.

### 2.2. Eligibility

Eligibility was restricted to women of Puerto Rican or Dominican Republic heritage. Exclusion criteria included:

- current medications that adversely influence glucose tolerance;
- multiple gestation;
- history of diagnosis of diabetes, hypertension, heart disease or chronic renal disease;
- and less than 16 years of age or over 40 years of age.

A total of 1626 prenatal care patients were enrolled in Proyecto Buena Salud. For the current analysis, we excluded 68 participants who experienced a miscarriage, 142 participants who did not deliver at Baystate, and 108 participants who did not have a GDM screen. From the remaining 1308 participants information on perceived stress during early or mid-pregnancy was available for 1115 (85%), with early pregnancy stress data available for 833 (75%) participants, and mid-pregnancy stress data available for 760 (68%) participants. Reasons for missing stress information included inability to locate women at the clinic or over the telephone (e.g., due to disconnected telephone) or preterm delivery.

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