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Adverse Childhood Experiences and Lifetime Adverse Maternal Outcomes (Gestational Diabetes and Hypertensive Disorders of Pregnancy) in the Hispanic Community Health Study/Study of Latinos

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Abstract

Purpose: Childhood adversity is associated with increased risk of adult disease, including type 2 diabetes and hypertension. However, little is known about potential associations between childhood adversity and adverse pregnancy outcomes. The goal of this study is to examine the

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relationship between adverse childhood experiences (ACEs) and ever experiencing gestational diabetes (GDM) or a hypertensive disorder of pregnancy (HDP) in a cohort of Hispanic/Latina women.

Methods: We analyzed data from 2,319 women from the Hispanic Community Health Study/ Study of Latinos (HCHS/SOL) who had ever given birth to a liveborn infant. We fit separate logistic regression models accounting for sample weights to examine the association between ACEs and risk of GDM and HDP adjusting for Hispanic/Latino background, age at immigration to the U.S., and education.

Results: Women who reported 4 or more ACEs did not show increased odds of GDM or HDP compared to those who reported three or fewer (GDM adjusted OR: 0.8 (0.5, 1.3); HDP adjusted OR: 1.0 (0.7, 1.5)).

Conclusions: Unlike previous research with majority non-Hispanic white cohorts, there was no association between ACEs and GDM or HDP. Future research should explore if this relationship varies by race/ethnicity in multiethnic cohorts.

Keywords

hypertensive disorders of pregnancy; childhood adversity; gestational diabetes

Background

Childhood adversity is associated with increased risk of cardiovascular disease and premature mortality.¹⁻³ Adverse childhood experiences (ACEs) are highly prevalent, particularly among underserved groups such as Hispanic/Latinos in the US.⁴ Despite the link between childhood adversity and adult disease, there has been little research on how experiencing childhood adversity may impact women's physical health during pregnancy.⁵⁻⁷

Rates of hypertensive disorders of pregnancy (HDP) and gestational diabetes have increased in the past two decades.^{6,7} Hispanic/Latina women have the highest prevalence of gestational diabetes in the U.S. and this prevalence has also increased more quickly among Hispanic/Latina women than those of other racial/ethnic groups.⁸ Though rates of HDP are relatively low among Hispanic/Latina women, gestational hypertension is the most common cause of pregnancy-related death among foreign-born Hispanic/Latina women and second most common among U.S.-born Hispanic/Latina women.⁹⁻¹¹ Both gestational diabetes and HDP are also associated with increased risk of severe maternal morbidity, poorer infant outcomes, and long-term increased risk of cardiovascular disease among mothers.^{12,13}

ACEs may increase the risk of pregnancy complications through multiple mechanisms.^{13,14} ACEs may result in chronic inflammation, resulting in long-term increased risk of pregnancy complications and cardiovascular disease.^{1,15,16} Those who experience ACEs are more likely to engage in unhealthy behaviors including smoking, obesity, or sedentary lifestyle, potentially increasing risk of pregnancy complications.¹ Finally, ACEs may alter biologic stress regulatory pathways, resulting in long-term altered responses to stress.^{1,17} Chronic inflammation, unhealthy behaviors and altered stress regulatory pathways are known or suspected risk factors for HDP¹⁸⁻²¹ and gestational diabetes.²² Despite biologic plausibility,

prior research of the relationship between ACEs and pregnancy complications has been inconclusive, with some studies reporting associations between cumulative ACE exposure and adverse pregnancy outcomes and other studies finding evidence of association only within specific subgroups or for specific types of childhood adversity^{23–30}

Understanding possible links between adverse childhood experiences and pregnancy complications will inform efforts to improve maternal health during and following pregnancy. Thus, the goal of this analysis is to estimate the association between cumulative ACEs and lifetime adverse maternal outcomes (gestational diabetes and HDP) among Hispanic/Latina women using data from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) and its Sociocultural Ancillary Study (SCAS).

Methods

Study Population

These data are from a subset of the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) and the HCHS/SOL Sociocultural Ancillary Study (SCAS). Study design and recruitment have been described elsewhere.^{31,32} Briefly, 16,415 Hispanic/Latino adults 18–74 years old (9,835 women) were randomly selected from Miami, Chicago, the Bronx, and San Diego. Individuals were eligible to participate if they were not currently pregnant, spoke English or Spanish, and self-identified as Hispanic/Latino. Participants completed a survey and health assessment between 2008–2011 (visit 1).³³ A subset participated in the SCAS (N= 5,313) and completed an additional survey with measures of psychosocial wellbeing and life experiences. Participants were followed up in 2014–2017 (visit 2), at which time they reported lifetime pregnancy complications.

For this study, we included women (of the 3,299 women who participated in both the SCAS and visit 2) with at least one live birth prior to visit 2 (N=2,461). We excluded women with incomplete information on childhood adversity (50) and who were missing information on gestational hypertension (74), preeclampsia (10), gestational diabetes (2), education (5), or Hispanic/Latino background (1). These excluded 92 women, resulting in analytic dataset of 2,319.

Measures

Our exposure of interest was a 0–10 scale of ACEs before age 18: abuse (physical, sexual, emotional), neglect (physical, emotional), parental separation, witnessing maternal abuse, living with a substance abuser, mentally ill person in the household, and household member imprisonment.² We considered ACEs both as a continuous score (0–10) and dichotomously, with participants reporting four or more ACEs considered exposed to severe childhood adversity.³⁴

Our first outcome was ever being diagnosed with gestational diabetes mellitus (GDM). This was assessed using self-report at visit 2 and scored as ever/never. Our second outcome was ever being diagnosed with any hypertensive disorder of pregnancy (any HDP, gestational hypertension or preeclampsia) also self-reported at visit 2. Maternal self-report of pregnancy

complications is a valid measure compared to medical records, even 5 years after the pregnancy.³⁵

Childhood environment, including socioeconomic position and social context, may confound the effect of ACEs on pregnancy complications.²⁹ Thus, we controlled for adult educational attainment (less than high school, high school diploma, at least some post-secondary education) and age at arrival in the United States (categorized as born in the 50 U.S. states or DC, born in a territory or foreign country and arrived as a child (<18 years old), or born in a territory or foreign country and arrived as an adult (>18 years old) and specific Hispanic/Latino background (Central American, Cuban, Dominican, Mexican, Puerto Rican, South American, or Mixed/Other) as proxies for childhood social environment.

Analysis

We conducted analysis using SAS survey procedures in order to account for HCHS/SOL complex survey design (SAS Institute, 2011). We fit logistic regression models for each outcome (GDM, any HDP) separately, considering ACEs as both a dichotomous (4 vs. 3 or fewer) and a continuous exposure. We produced crude odds ratios as well as odds ratios adjusted for age at arrival, educational attainment, and Hispanic/Latino background. We considered age at arrival as a potential effect modifier in all models.

Sensitivity Analyses

Our first sensitivity analysis was to refit models for the subset of women who had a live birth between visits 1 and 2, controlling for age at pregnancy and parity, two potential confounders only available for this subset, in addition to covariates listed above. Second, we fit models considering different cutpoints for a dichotomous ACE exposure (any vs. none, 2 vs. 1 or fewer, 3 vs. 2 or fewer). We considered each ACE as an independent exposure to consider possible independent effects. Finally, we dropped parental separation, the most common ACE, and considered it as a control variable instead, as it may indicate socioeconomic position and family structure, rather than adversity. We compared odds ratio estimates produced using multiple imputation to the complete case results (10 imputations).

Results

Overall, 12.2% of women reported ever experiencing gestational hypertension, 9.2% gestational diabetes, and 6.3% preeclampsia (Table 1). These percentages were similar across women who reported 3 or fewer ACEs compared to women who reported 4 or more. Over three-quarters of women (77.4%) reported at least one ACE and almost a third (31.6%) reported four or more ACEs (median ACE score: 1.5, interquartile range: 3.7). The most common ACE was parental separation/divorce (41.8%). Women who reported four or more ACEs tended to have a Cuban or Central American background, reported more lifetime pregnancies, tended to be a current smoker at visit 1, had a higher mean body mass index (BMI) at visit 1, tended to be single, and tended to be born in the 50 U.S. states compared to women reporting 3 or fewer ACEs. Generally, women reporting more than 4 ACEs showed similar cardiovascular health profiles (e.g., BMI, hypertension, diabetes) at visit 1 to those who reported 3 or fewer.

Controlling for education, age at immigration to the U.S., and Hispanic/Latino background, there were no associations between ACEs and GDM or any HDP (Table 2). Among women who reported experiencing 4 or more ACEs, the adjusted odds of GDM were 20% lower (aOR: 0.8 (0.5, 1.3)) compared to women who reported experiencing 3 or fewer ACEs. Similarly, the odds of any HDP were not different among women who reported experiencing 4 or more ACEs compared to those who experienced 3 or fewer (aOR: 1.0 (0.7, 1.5)). There was no evidence of multiplicative effect modification by age at arrival.

As a sensitivity analysis, we replicated our model using the subset of women who gave birth to a live infant between visits 1 and 2 (Table 3). This subset was younger (mean age 28.2) and more likely to be U.S. born (25.4%) than the overall sample with a similar mean number of ACEs. After conditioning on parity, age at pregnancy, education, Hispanic/Latino background, and age at arrival to the U.S., the odds of GDM were lower among women who had experienced 4 or more ACEs compared to those who had experienced 3 or fewer, though the estimate was imprecise (OR: 0.4 (0.1, 1.6)). Similarly, the odds of any HDP were lower among women who had experienced 4 or more ACEs, with even less precise confidence intervals (OR: 0.8 (0.1, 5.6)).

We conducted four additional sensitivity analyses. First, the association between individual ACEs and gestational diabetes or gestational hypertension was null, with the exception of having a family member who had been mentally ill or committed suicide. This was associated with any HDP (aOR: 1.7 (1.1, 2.6)). Second, we considered varying cutoffs for dichotomizing experienced ACEs and a continuous score. Results were similarly null for both GDM or any HDP if we operationalized ACEs at 1 v. 0, 2 v. 1 or less, 3 v. 2 or less or as a continuous score (0-10). Third, we considered parental separation as a control variable rather than one of the 10 ACEs. This did not change estimates meaningfully (GDM aOR: 0.8 (0.5, 1.4); HDP aOR: 0.9 (0.6, 1.4)). Finally, imputing values for the 92 observations with missing data did not change estimates meaningfully (GDM aOR: 0.8 (0.5, 1.3), HDP aOR: 1.1 (0.7, 1.5)).

Discussion

In our population, childhood adversity was not associated with increased lifetime risk of GDM or any HDP. This result was consistent across different operationalizations of ACEs, individual ACEs (except one, which could be due to chance), and in sensitivity analyses controlling for age at pregnancy. This is distinct from previous findings that show a relationship between childhood adversity and gestational diabetes, both among majority non-Hispanic white populations.^{6,7}

Although the two studies examining relationships between childhood adversity and GDM show positive associations, the larger body of literature examining ACEs with respect to related perinatal outcomes (e.g., preterm birth) is equivocal.^{27,30} The relationship between ACEs and adverse pregnancy outcomes may vary by depressive symptoms,⁶ social support,²⁴ or additional experiences of violence.²³ Further, the relationship between ACEs and perinatal outcomes may differ among non-white women, due to plateauing effects of

additional stressors that are more prevalent among non-white women (e.g., discrimination).^{25,36}

This project has several important limitations. First, measures of adverse childhood experiences and pregnancy complications were retrospectively self-reported. This may induce recall bias. However, the prevalence of gestational diabetes was consistent with NHANES data considering lifetime experience of gestational diabetes. The retrospective measurement of childhood experiences may induce or may simply capture a different at-risk population than prospective measurement. Second, we are unable to control for potential key confounders, such as childhood socioeconomic status or women's age at pregnancy (as it was not asked in HCHS/SOL for pregnancies prior to visit 1). Evidence suggests that childhood adversity may be associated with earlier childbearing in the U.S.,³⁸ and younger maternal age is protective against HDP and gestational diabetes. Thus, estimates may appear to be protective if we do not control for age.³⁹ However, in a sensitivity analysis controlling for age at pregnancy, the associations were unchanged. Finally, the ACE scale does not consider all possible adverse experiences and may exclude important experiences such as exposure to war or community violence.

This project's strengths include a large, representative cohort of Hispanics/Latinas living in four U.S. urban communities; the ability to conduct a sensitivity analysis with a subset of women with more recent pregnancies; and information on women's place of birth, often missing from national datasets. Our results do not support an association between childhood adversity and pregnancy complications in Hispanic/Latina women. However, future research should continue to explore how childhood adversity may impact women's health during pregnancy, taking into account potential effect modification by maternal depression, and possible differences in experiences across racial/ethnic/nativity groups.

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Acronyms:

ACEs	Adverse childhood experiences
HDP	hypertensive disorders of pregnancy
BMI	body mass index

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Table 1.

Maternal Characteristics by Adverse Childhood Experiences, Hispanic/Latina women who ever gave birth to a live infant, Hispanic Community Health Study/Study of Latinos, N=2,332

	Overall (N=2,319) Mean/% (95% CI)	3 or fewer ACEs (N=1,582) Mean/% (95% CI)	4 + ACEs (N=737) Mean/% (95% CI)
Gestational Hypertension, %	12.2 (10.4, 14.2)	11.9 (9.8, 14.4)	13.0 (9.7, 17.0)
Gestational Diabetes, %	9.2 (7.7, 10.9)	9.5 (7.8, 11.6)	8.4 (6.1, 11.6)
Preeclampsia, %	6.3 (5.0, 7.9)	6.3 (4.7, 8.5)	6.4 (4.6, 8.8)
Age (years)	46.9 (45.9, 47.9)	47.5 (46.5, 48.5)	45.6 (43.6, 47.5)
Hispanic/Latino Background, %			
Central American	8.1 (6.5, 10.1)	8.5 (6.6, 10.8)	12.6 (8.8, 17.6)
Cuban	19.9 (15.5, 25.2)	23.2 (18.1, 29.4)	36.7 (30.4, 43.4)
Dominican	12.6 (10.1, 15.8)	12.4 (9.8, 15.6)	7.6 (5.6, 10.2)
Mexican	37 (32.2, 42.2)	37.3 (31.5, 43.5)	22.9 (17.3, 29.7)
Puerto Rican	15.8 (12.9, 19.1)	12.6 (9.7, 16.2)	5.1 (3.4, 7.6)
South American	4.8 (3.9, 6.0)	4.7 (3.7, 5.9)	2 (0.8, 4.8)
Mixed/Other	1.6 (1.0, 2.6)	1.3 (0.8, 2.2)	1.6 (1.0, 2.6)
Parity (Visit 2)	2.9 (2.8, 3)	2.8 (2.7, 2.9)	3 (2.8, 3.2)
Smoking, %			
Never	70 (67.2, 72.6)	73 (70.2, 75.7)	64.1 (57.7, 69.9)
Former	15.1 (13.4, 17)	14.3 (12.3, 16.4)	16.8 (13.2, 21.1)
Current	14.9 (12.8, 17.3)	12.7 (10.6, 15.2)	19.2 (15.1, 24.1)
Education, %			
Less than High School	34.9 (31.6, 38.4)	33.9 (29.9, 38.1)	37 (31.5, 42.8)
High School	24.9 (22.3, 27.7)	25.2 (22.5, 28.2)	24.3 (18.8, 30.8)
Greater than High School	40.2 (36.4, 44.1)	40.9 (36.4, 45.5)	38.8 (32.7, 45.2)
BMI (kg/m ²)	30.3 (29.9, 30.8)	29.9 (29.5, 30.3)	31.4 (30.4, 32.3)
Hypertension, %	26 (23.2, 28.9)	26.4 (23.5, 29.5)	25 (19.5, 31.5)
Diabetes, %			
No diabetes	45.8 (42.6, 49.1)	44.6 (40.8, 48.5)	48.7 (42.7, 54.7)
Pre-diabetes	34.8 (31.6, 38.1)	35.7 (32.2, 39.5)	32.6 (26.9, 38.8)
Diabetes	19.4 (17.2, 21.9)	19.7 (17.2, 22.5)	18.8 (15.0, 23.2)
Marital Status, %			
Single	20.4 (18.1, 22.8)	18.2 (15.9, 20.8)	25.1 (20.5, 30.2)
Married/Living with a Partner	52.9 (49.2, 56.6)	54.3 (49.7, 58.8)	49.8 (43.5, 56)
Separated/Divorced/Widowed	26.7 (23.8, 30)	27.6 (24.1, 31.3)	25.2 (19.6, 31.7)
Age at Immigration to U.S. 50 states			
US-born	12.8 (10.8, 15.2)	9.7 (7.9, 11.8)	19.7 (15.2, 25.2)
Immigrated <18 years	13.9 (11.3, 16.9)	11.6 (9, 15)	18.9 (13.7, 25.6)
Immigrated 18 years	73.3 (69.6, 76.7)	78.7 (74.8, 82.2)	61.4 (54.5, 67.8)
Number of Adverse Childhood Experiences, %			
0	22.6 (20.1, 25.3)	33.1 (29.9, 36.5)	

	Overall (N=2,319)	3 or fewer ACEs (N=1,582)	4 + ACEs (N=737)
	Mean/% (95% CI)	Mean/% (95% CI)	Mean/% (95% CI)
1	20.9 (18.6, 23.4)	30.5 (27.3, 33.9)	
2	12.7 (11.1, 14.5)	18.5 (16.1, 21.2)	
3	12.2 (10.0, 14.8)	17.9 (14.9, 21.3)	
4 or more	31.6 (24.1, 41.7)		100.0
Specific Adverse Childhood Experiences, %			
Emotional Abuse	32.7 (29.3, 36.1)	10.4 (7.8, 13.8)	79.5 (74.8, 83.4)
Physical Abuse	29.7 (26.2, 33.2)	9.0 (6.5, 12.3)	73.7 (68.0, 78.7)
Sexual Abuse	20.7 (18.0, 23.5)	7.7 (5.8, 10.2)	48.2 (42.0, 54.5)
Emotional Neglect	26.5 (23.4, 29.6)	9.6 (7.7, 11.8)	62.4 (56.1, 68.3)
Physical Neglect	11.2 (9.3, 13)	2.8 (2, 4.1)	28.8 (24.0, 34.3)
Parents Separated/Divorced	41.8 (38.4, 45.2)	31.1 (28.1, 34.4)	64.6 (57.9, 70.8)
Witnessed Maternal Abuse	21.7 (18.5, 25)	6.8 (5.4, 8.5)	53.6 (47.4, 59.8)
Household Member Abused Alcohol/Street Drugs	34.2 (31.1, 37.4)	17.9 (14.9, 21.4)	68.7 (62.1, 74.7)
Household Member Mentally Ill/Attempted Suicide	22.8 (20.2, 25.3)	11.8 (9.8, 14)	46 (39.6, 52.4)
Household Member went to Prison	22.7 (20.3, 25.1)	13.4 (11.4, 15.8)	42.5 (36.6, 48.7)

^aAll variables measured at baseline (visit 1) or Sociocultural Ancillary Study unless otherwise indicated

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Table 2.

Crude and adjusted associations between ACEs and gestational diabetes and any hypertensive disorder of pregnancy, Hispanic Community Health Study/Study of Latinos, SCAS, N=2,332

	Gestational Diabetes	
	OR (95% CI)	aOR (95% CI) *
ACES 4+ vs. 3 or less	0.88 (0.57, 1.34)	0.80 (0.51, 1.27)
Continuous ACE score	0.98 (0.91, 1.05)	0.96 (0.88, 1.04)
Any Hypertensive Disorder of Pregnancy		
	OR (95% CI)	aOR (95% CI) *
ACES 4+ or less	1.03 (0.71, 1.47)	1.03 (0.71, 1.49)
Continuous ACE score	1.03 (0.96, 1.11)	1.03 (0.96, 1.11)

* Adjusted for education, age at USA arrival, Hispanic/Latino background

ACE=Adverse childhood experience, OR= odds ratio, aOR= adjusted odds ratio, CI: confidence interval

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Table 3.

Crude and adjusted estimated association between ACEs and gestational diabetes and any hypertensive disorder of pregnancy, women who gave birth to a live infant between visits 1 and 2, Hispanic Community Health Study/Study of Latinos, N=110

	Gestational Diabetes		
	Model 0	Model 1	Model 2
	OR (95% CI)	OR (95% CI)	OR (95% CI)
ACES 4+ v. 3 or less	0.6 (0.2, 2.0)	0.4 (0.1, 1.8)	0.4 (0.1, 1.6)
	Any Hypertensive Disorder of Pregnancy		
	OR (95% CI)	OR (95% CI)	OR (95% CI)
	ACES 4+ v. 3 or less	0.6 (0.1, 3.1)	0.7 (0.1, 3.9)

M0: unadjusted

M1: adjusted for education, Hispanic/Latino background, USA arrival

M2: Model 1 plus parity and age at pregnancy

Abbreviations: ACE: adverse childhood experience, OR: odds ratio, CI: confidence interval

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