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Childhood abuse, intimate partner violence, and placental abruption among Peruvian women

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Abstract

Purpose: Experiencing childhood abuse (CA) or intimate partner violence (IPV) has been linked to adverse pregnancy outcomes. We examined whether CA history and IPV in the current pregnancy are independently and jointly associated with placental abruption (PA).

Methods: We recruited 662 PA cases and 665 controls in Lima, Peru. We used multivariate logistic regression procedures to calculate odds ratios, adjusting for age, education, and parity.

Results: Approximately 42% of cases and controls reported CA; 50% of cases and 49% of controls reported IPV. History of any CA was not associated with PA, but history of severe CA (>1 CA event; 25% of women) was associated with 38% increased odds of PA (aOR=1.38; 95%CI: 1.07–1.80), adjusting for IPV. There was a small, statistically nonsignificant association between severe IPV (20% of women) and odds of PA (aOR=1.22; 95%CI: 0.92–1.62), adjusting for CA. Women who experienced severe CA and severe IPV had 2.06-fold (95%CI:1.25–3.40) increased odds of PA compared to women who did not experience severe abuse. The joint effect of CA and IPV was positive but statistically nonsignificant on the multiplicative (aOR=1.48; 95%CI: 0.79–2.80) and additive scale (RERI=0.70; 95%CI: −0.39–1.78).

Conclusions: Efforts to prevent exposure to violence may improve maternal outcomes.

Keywords

Adult survivors of child abuse; Intimate partner violence; Abruptio placentae; Peru

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Introduction

Placental abruption (PA) affects approximately 1% of births and greatly elevates risk of fetal growth restriction, preterm birth, and stillbirth (Tikkanen et al. 2009; Oyelese and Anath 2006; Anath et al. 1999). Smoking, drug and alcohol use, physical trauma, Cesarean first birth, advanced maternal age, and chronic hypertension have all been associated with increased risk of PA (Aliyu et al. 2011, Frankenberger et al. 2015; Cnattingius et al. 2004; Williams et al. 1991; Oyelese and Anath 2006). The causes underlying many PA cases remain unknown.

Recent literature has documented associations of adverse experiences in childhood, including physical and sexual abuse, with a number of peripartum health problems among adult women. For example, maternal report of adverse childhood experiences has been associated with elevated risks of low birth weight and preterm birth (Selk et al. 2015, Wosu et al. 2015), intrauterine fetal demise (Goyal et al. 2015), gestational diabetes (Mason et al. 2016), premature contractions, and cervical insufficiency (Leeners et al. 2010). Adult survivors of childhood abuse (CA) are more likely than non-abused adults to smoke cigarettes, have abused alcohol or other drugs (Leeners et al. 2014; McCauley et al. 1997), and have poor psychological health, such as posttraumatic stress disorder, depression, anxiety, and low self-esteem (McCauley et al. 1997; Hornor 2010; Riley et al. 2010; Suglia et al. 2014); and they are also more likely to be abused by an intimate partner in adulthood (Barrios et al. 2015). Although no study has yet evaluated the extent to which, if at all, CA may increase the risk of PA, associations with other obstetric complications suggest that adverse childhood experiences may negatively impact women's peripartum health.

Prior publications, including one from our group, have shown that women who experience CA are more likely to experience intimate partner violence (IPV) (Barrios et al. 2015). IPV is a serious global health problem, with estimated lifetime prevalence ranging from 15 to 71% (Bailey 2010), and has been linked to elevated risk of PA in several (Leone et al. 2010; El Kady et al. 2005), though not all (Yost et al. 2005; Shumway et al. 1999), epidemiological studies. Prior work evaluating migraine and post-traumatic stress disorder in pregnant women has produced evidence of interaction between CA and adult IPV (Gelaye et al. 2016; Sanchez et al. 2017). However, no previous study has explored the risk of PA among women experiencing both CA and IPV. To investigate this possible interaction, we examined the independent and joint effects of CA and IPV history and odds of PA in a large case-control study in Peru.

Materials and Methods

Study population

We analyzed data from the Placental Abruption Genetic Epidemiology (PAGE) study. The PAGE study was conducted in Lima, Peru in the following hospitals: Instituto Nacional Materno Perinatal, Hospital Rebagliati, Hospital San Bartolome, Hospital Hipolito, Hospital Loayza, Hospital Dos de Mayo, and Hospital Maria Auxiliadrosa. Between March 2013 and December 2015, women were identified as eligible for interview during the in-patient labor and delivery period by the following procedures. Research staff identified eligible women by

reviewing admission logbooks for the emergency room, labor and delivery, and surgery. Women were recruited during their hospital stay. Women who were not residents of Lima, had known multi-fetal pregnancies, or whose medical records contained insufficient information to determine case or control status were excluded. The study protocol was approved by the Institutional Review Boards of participating institutions and the Swedish Medical Center, Seattle, WA, where the study was based. All participants provided written informed consent.

Ascertainment of PA

PA cases were identified daily by reviewing logbooks from emergency room admissions and labor and delivery admissions, as well as surgery report books to catch post-operative diagnoses. Study personnel made periodic visits to specific wards in a fixed order for the purposes of identifying potential PA cases for the present study. PA cases were selected based on evidence of retroplacental bleeding (fresh blood entrapped between the decidua and the placenta) or blood clots behind the placenta and two of the following: (i) vaginal bleeding in late pregnancy not due to placenta previa or cervical lesions; (ii) uterine tenderness and/or abdominal pain; (iii) fetal distress or death. Other possible diagnoses associated with third trimester bleeding (i.e., placenta previa, appendicitis, urinary tract infection, preterm labor, fibroid degeneration, ovarian pathology, and muscular pain) were exclude to ensure that true PA cases were identified. Controls were selected from eligible pregnant women who delivered at participating hospitals during the study period and who did not have a diagnosis of placental abruption in the current pregnancy. The control women were approached in order of delivery date.

Ascertainment of CA and IPV

Information about CA and IPV was collected along with demographic information in one-hour in-person interviews. These interviews were conducted after delivery as participants recovered in the hospital, within 72 hours of the PA. Medical records were also reviewed for information about medical and reproductive history.

CA was defined as physical and sexual abuse perpetuated by an adult (or, for sexual abuse, someone at least 5 years older than the participant) during the first 18 years of a participant's life. To measure CA, study staff asked each participant 3 questions concerning physical abuse (i.e., whether a parent, step-parent, or adult living in her home pushed, grabbed, shoved, slapped, or threw something at her; hit hard enough to leave a mark; or acted threatening) and 4 questions about sexual abuse (i.e., if she was ever touched or fondled sexually; someone had her touch them sexually; someone attempted intercourse; or someone actually had intercourse with her). Each question was considered an abuse event, and the total number of events that the participant reported were summed. We additionally created a binary indicator variable for CA severity. Severe CA was defined as experiencing at least 2 events; all other participants were categorized as having experienced no/rare CA (0 or 1 events).

IPV was defined as physical, emotional, and sexual abuse perpetuated during the current pregnancy by the participant's husband or boyfriend. To measure IPV, study staff asked each

participant to report how often each of 13 abusive acts were done to her (never, infrequently (1 or 2 times a month), sometimes (almost weekly) or often (all the time)). Frequency responses were recorded as 0, 1, 2, or 3 and summed to create a scale ranging from 0 to 39. Based on this sum, IPV severity was categorized as None (0), Infrequent (1–2), Sometimes (3–7), or Often (>=8). We additionally created a binary indicator variable for IPV severity. Severe IPV was defined as a score of 3 or higher on the scale; no/rare IPV was defined as a score of 0, 1, or 2.

To evaluate independent and joint effects of CA and IPV, participants were additionally divided into 4 categories of joint exposure: no or rare abuse (no/rare CA, no/rare IPV); severe CA only (severe CA, no/rare IPV); severe IPV only (no/rare CA, severe IPV); and severe CA and IPV (severe CA, severe IPV).

Statistical Analysis

Analyses were restricted to singleton births who were not missing information on CA, IPV, age, education, or parity (n=41 cases and 31 controls). The final analytic study population consisted of 621 cases and 634 controls. Logistic regression models were used to calculate odds ratios and 95% confidence intervals (CI) for the association between CA and IPV. Models were adjusted for variables chosen *a priori*: age (continuous), education (Secondary education or less, Technical or university education), and parity (continuous). In addition to analysis using the whole population, models were additionally stratified by cases' gestational age (Early preterm (<34 weeks); Late preterm (34–36 weeks); Term (>=37 weeks)) to qualitatively examine effect modification by gestational age.

As a sensitivity analysis, independent and joint effects of CA and IPV were assessed in a second way. To measure the independent effect of CA, logistic models for severe vs. rare CA were additionally adjusted for IPV. To measure the independent effect of IPV, logistic models for severe vs. rare IPV were additionally adjusted for CA. We calculated the relative excess risk due to interaction (RERI) to assess evidence of greater-than-additive joint effects (VanderWeele & Knol 2014). We calculated the interaction term from a fully-adjusted logistic model containing terms for severe CA, severe IPV, and their product to assess evidence of greater-than-multiplicative joint effects.

Results

PA cases and controls were similar in age, marital status, smoking and alcohol use, and infant sex. However, PA cases had higher education, were more likely to have major depression, were less likely to have prenatal care, and were more likely to be nulliparous. PA cases were also more likely to report first trimester bleeding, to have a diagnosis of preeclampsia or eclampsia, and to have a low birth weight infant, preterm delivery, or a stillbirth (Table 1).

History of any CA was not significantly associated with increased odds of PA in adjusted models (OR=1.05; 95% CI: 0.83–1.32). Similarly, compared to women who reported no experience of CA, those who reported experiencing only physical abuse, only sexual abuse, or both physical and sexual CA did not have significantly elevated odds of PA. However,

increasing number of reported CA events experienced was associated with significantly increased odds of PA (P_{trend} = 0.036). Those who reported experiencing 3 or more CA events had 1.56-times (95% CI: 1.11, 2.19) higher odds of PA compared to those who reported experiencing no CA (Table 2).

History of any IPV was not significantly associated with odds of PA in adjusted models (OR= 1.16; 95% CI: (0.93, 1.46)). Increasing severity of IPV experienced was non-significantly associated with increased odds of PA (P_{trend} = 0.089). Those experiencing the most frequent IPV had 1.41 (95% CI: 0.91, 2.19) times higher odds of PA than those experiencing no IPV (Table 2).

Compared to those experiencing no or rare abuse, women experiencing only severe CA or only severe IPV had non-significantly elevated odds of PA (OR= 1.27 (95% CI: 0.95, 1.71) and 1.09 (95% CI: 0.79, 1.52), respectively). However, women experiencing joint exposure to severe CA and severe IPV had 2.06 (95% CI: 1.25, 3.40) times higher odds of PA compared to those experiencing no or rare abuse (Table 2).

Given the well-established relationship between PA and gestational age, we examined the extent to which the relationship between CA, IPV, and PA varied by gestational age. We found no evidence that any CA versus no CA, or any IPV versus no IPV, was associated with elevated odds of PA. Increasing number of CA events experienced was associated with significantly increased odds of PA among early preterm deliveries (P_{trend} = 0.0058). Among PA cases delivering early preterm, experiencing 3 or more CA events was associated with 1.87 (95% CI: 1.22, 2.87) times higher odds of PA than experiencing no CA. Similarly, among women delivering early preterm, experiencing joint exposure to severe CA and severe IPV was associated with 2.85 (95% CI: 1.56, 5.20) times higher odds of PA compared to experiencing no or rare abuse (Table 3). Product terms between gestational age category and type of CA, number of CA events, and joint exposure variables were all non-significant.

In the sensitivity analysis adjusting for each type of violence, results were similar to the 4-category analysis. Without adjustment for severe IPV, women who experienced severe CA had 1.39 (95% CI: 1.07, 1.81) times higher odds of PA compared to women experiencing no or rare CA; adjusting for IPV did not materially alter this association (OR= 1.38; 95% CI: (1.07, 1.80)). Without adjustment for severe CA, women who experienced severe IPV had 1.23 (95% CI: 0.93, 1.63) times higher odds of PA compared to women experiencing no or rare IPV; adjusting for CA similarly did not influence this association (OR= 1.22; 95% CI: (0.92, 1.62)). The joint effect of CA and IPV was positive but statistically nonsignificant on the multiplicative scale (interaction OR=1.48; 95% CI: (0.79, 2.80)) and additive scale (relative excess risk due to interaction (RERI)=0.70; 95% CI: (−0.39, 1.78)). In two separate sensitivity analyses, we additionally repeated the main analysis first limiting to incident PA cases (excluding 23 women with a prior PA) and then excluding 11 women with chronic hypertension. These restrictions did not materially alter the results (not shown).

Discussion

In a large population of Peruvian women, we report independent and joint effects of CA and IPV on odds of PA. Specifically, we found that CA was associated with 38% higher odds of PA after adjusting for IPV, and IPV was associated with 21% higher odds of PA after adjusting for CA, while women experiencing both severe CA and severe IPV had over twice the odds of PA compared to women who experienced no or rare abuse. The statistical interaction between CA and IPV was positive, but not statistically significant. To our knowledge, this is the first study to examine the association between CA history and risk of PA in adulthood.

Although analyses taking IPV severity into account suggested a positive association between increasing severity of IPV and increasing odds of PA, none of the models we tested were statistically significant. These findings are in line with two small studies of IPV and PA, which also failed to find a significant association (Yost et al. 2005; Shumway et al. 1999), but disagree with a third large study that reported a 5-fold elevated risk of PA among women experiencing IPV in pregnancy (Leone et al. 2010). That study was conducted in the US and used only 2 questions to assess IPV (one about physical violence in the last year, and the second about feeling unsafe at home), which suggests that only physical and severe psychological IPV were measured. The study also reported IPV prevalence of 3.7%. The differing exposure definition and population for this study may explain the discrepancy in the findings.

We did not find a statistically significant association between PA and history of any CA, but we did find an association between increasing severity of CA and PA. Increasing severity of adverse childhood experiences (including CA) has been linked to increasing risk of numerous diverse health outcomes, including heart disease, cancer, and migraine (Felitti et al. 1998; Gelaye et al. 2016). Our results, therefore, contribute to a large literature indicating that CA severity has a dose-response relationship with a variety of poor health outcomes.

The associations between CA and IPV and PA odds were stronger in early preterm PA cases than in later preterm or term PA cases. Some placental abruptions are caused by acute trauma, but many may arise from a longer-term process hypothesized to begin early in pregnancy, suggesting that pre-pregnancy health factors may be important to predict risk (Oyelese and Anath 2006). For example, stress among women who were abused in childhood has been hypothesized to manifest in increased corticotropin-releasing hormone production by the placenta (pCRH) during pregnancy (Horan et al. 2000). Limited evidence indicates that women who experienced childhood trauma have higher pCRH levels during the second half of pregnancy (Moog et al. 2016), and placentas from abruptions express more pCRH than placentas from spontaneous preterm labors (Trivedi et al. 2012). In this study, IPV did not appear to mediate the association between CA and PA, further suggesting that CA may act through an alternate and potentially longer-term process beginning before the most recent pregnancy. Preliminary evidence links maternal depression, anxiety, and stress to elevated PA risk, and further investigation into psychological health as a mechanism is warranted (de Paz et al. 2011).

This study had several important strengths. We were able to utilize data on a large number of pregnancies. Additionally, the study was designed to collect more than 600 PA cases, allowing power to examine moderately strong risk factors like CA and IPV. We collected detailed information about CA and IPV, asking each participant multiple questions about each and collecting information about occurrence and severity. Finally, we collected complete information on a variety of other risk factors for PA, including smoking, alcohol use during pregnancy, reproductive history, and a variety of sociodemographic factors.

Our study, however, also has some notable limitations. This was a retrospective study, and women were asked to report a history of violence after experiencing PA. Therefore, we cannot eliminate the possibility of recall bias affecting our results. To mitigate the risk of recall bias, participants were not informed of study hypotheses. Furthermore, to ensure data quality, interviewers were trained and validated questionnaires were used. Additionally, we were unable to precisely characterize the effect of possible mediators, such as smoking, alcohol use, and depression. Tobacco and alcohol were used very infrequently in this population, and depression was measured after delivery and so reports of depression likely do not reflect pre-delivery mental health. Finally, relatively few women (49 cases and 28 controls) experienced both severe CA and severe IPV, reducing the precision of our estimates of the joint effect. Similarly, we were not able to assess each type of IPV (e.g., emotional, physical, sexual, or controlling behavior) independently of other types, as nearly every woman who reported any IPV reported experiencing emotional IPV (in addition to other types).

In conclusion, we found both joint and independent effects of CA and IPV on odds of PA, as well as evidence suggesting a threshold effect for the association between experiencing severe violence and elevated PA odds. Our findings provide further evidence that public health efforts to prevent exposure to violence or mitigate its effects may improve maternal outcomes. Future research should focus on factors that might mediate the association between history of violence and PA, in order to identify opportunities for intervention.

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Abbreviations and acronyms

CA:	childhood abuse
CI:	confidence interval
IPV:	intimate partner violence
OR	odds ratio
PA	placental abruption
PAGE	Placental Abruption Genetic Epidemiology
pCRH	placental corticotropin releasing hormone

RERI relative excess risk due to interaction

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Table 1.

Demographic and clinical characteristics of the population

	PA (N=621)		No PA (N=634)		P
	n	%	n	%	
Maternal age (mean (SD))	28.7 (6.7)		28.1 (6.4)		0.15
18–19	39	6.3	52	8.2	0.08
20–29	315	50.7	320	50.5	
30–34	124	20.0	147	23.2	
35+	143	23.0	115	18.1	
Pre-pregnancy BMI (mean (SD))	24.6 (3.8)		25.0 (3.9)		0.08
<25	362	59.7	369	59.5	0.17
25.0–29.9	190	31.4	177	28.6	
30.0+	54	8.9	74	11.9	
Maternal education <12 years	411	66.2	473	74.6	0.0011
Worked while pregnant	337	54.4	334	52.7	0.55
Married/cohabitating	532	86.0	554	87.4	0.45
Major depression (PHQ-9)	116	18.8	64	10.2	<0.0001
Fair/poor self-rated pre-pregnancy health	121	19.6	89	14.1	0.0097
Chronic hypertension	8	1.3	3	0.5	0.12
Parity					0.021
Nulliparous	285	45.9	250	39.4	
Multiparous	336	54.1	384	60.6	
No prenatal care	38	6.1	17	2.7	0.0030
Unplanned pregnancy	376	60.7	382	60.4	0.89
Alcohol use in pregnancy	108	17.5	114	18.0	0.80
Cigarette smoking in pregnancy	10	1.6	4	0.6	0.10
Male infant	345	56.1	334	52.9	0.26
First trimester bleeding	121	19.6	65	10.3	<0.0001
Previous placental abruption[1]	22	5.2	1	0.2	<0.0001
Stillbirth	64	10.3	1	0.2	<0.0001
Preterm delivery (<37 wk)[2]	340	61.0	15	2.4	<0.0001
Low birth weight (<2500 g)[2]	277	50.3	14	2.2	<0.0001
Preeclampsia/eclampsia	135	22.0	41	6.5	<0.0001

All analyses restricted to singleton births

[1]Previous placental abruption among women with prior pregnancies only (n=425 cases, 446 controls).

[2]Restricted to live births only (n=557 cases, 633 controls)

Table 2.

Childhood abuse, IPV, and odds of PA

	PA (N=621) n (%)	No PA (N=634) n (%)	OR (95% CI)	Adjusted OR (95% CI)
Any CA				
None	362 (58.3)	369 (58.2)	Ref	Ref
Any	259 (41.7)	265 (41.8)	1.00 (0.80, 1.25)	1.05 (0.83, 1.32)
Type of CA				
No CA	362 (58.3)	369 (58.2)	Ref	Ref
Physical abuse only	214 (34.5)	226 (35.7)	0.97 (0.76, 1.22)	1.02 (0.80, 1.29)
Sexual abuse only	11 (1.8)	13 (2.1)	0.86 (0.38, 1.95)	0.89 (0.39, 2.04)
Physical and sexual abuse	34 (5.5)	26 (4.1)	1.33 (0.78, 2.27)	1.40 (0.82, 2.40)
Number of CA events				
0	362 (58.3)	369 (58.2)	Ref	Ref
1	87 (14.0)	121 (19.1)	0.73 (0.54, 1.00)	0.75 (0.55, 1.03)
2	69 (11.1)	69 (10.9)	1.02 (0.71, 1.47)	1.05 (0.72, 1.51)
3+	103 (16.6)	75 (11.8)	1.40 (1.01, 1.95) *	1.56 (1.11, 2.19) **
Test for Trend	--	--	*0.12*	*0.036*
Any IPV				
None	310 (49.9)	326 (51.4)	Ref	Ref
Any	311 (50.1)	308 (48.6)	1.06 (0.85, 1.33)	1.16 (0.93, 1.46)
IPV severity				
None (0)	310 (49.9)	326 (51.4)	Ref	Ref
Infrequent (1–2)	179 (28.8)	187 (29.5)	1.01 (0.78, 1.30)	1.09 (0.84, 1.42)
Sometimes (3–7)	81 (13.0)	78 (12.3)	1.09 (0.77, 1.55)	1.20 (0.84, 1.71)
Often (8–39)	51 (8.2)	43 (6.8)	1.25 (0.81, 1.93)	1.41 (0.91, 2.19)
Test for Trend	--	--	*0.34*	*0.089*
IPV and CA				
No or rare abuse	363 (58.5)	397 (62.6)	Ref	Ref
Severe CA only	126 (20.3)	116 (18.3)	1.19 (0.89, 1.59)	1.27 (0.95, 1.71)
Severe IPV only	86 (13.9)	93 (14.7)	1.01 (0.73, 1.40)	1.09 (0.79, 1.52)
Severe CA and IPV	46 (7.4)	28 (4.4)	1.80 (1.10, 2.94) *	2.06 (1.25, 3.40) **

Adjusted OR is adjusted for age, education, and continuous parity

* P < 0.05;

** P <0.01

Table 3.

Effect by gestational age (adjusted ORs and 95% CI)

	Early preterm PA (<34) Cases n = 254	Late preterm PA (34–36) Cases n = 130	Term PA (>=37) Cases n = 237
Any CA			
None	Ref	Ref	Ref
Any	1.25 (0.92, 1.68)	0.75 (0.50, 1.11)	1.05 (0.77, 1.43)
Type of CA			
No CA	Ref	Ref	Ref
Physical abuse only	1.18 (0.86, 1.62)	0.70 (0.45, 1.07)	1.07 (0.78, 1.48)
Sexual abuse only	0.61 (0.17, 2.18)	1.40 (0.44, 4.45)	0.93 (0.30, 2.92)
Physical and sexual abuse	2.17 (1.16, 4.05) *	0.85 (0.32, 2.29)	0.95 (0.43, 2.09)
Number of CA events			
0	Ref	Ref	Ref
1	0.85 (0.56, 1.30)	0.63 (0.36, 1.11)	0.75 (0.48, 1.16)
2	1.31 (0.82, 2.10)	0.63 (0.31, 1.28)	1.06 (0.65, 1.73)
3+	1.87 (1.22, 2.87) **	1.06 (0.59, 1.89)	1.57 (1.01, 2.43) *
Test for trend	*0.0058*	*0.55*	*0.11*
Any IPV			
None	Ref	Ref	Ref
Any	1.18 (0.87, 1.59)	1.32 (0.90, 1.94)	1.09 (0.81, 1.48)
IPV severity			
None (0)	Ref	Ref	Ref
Infrequent (1–2)	1.02 (0.72, 1.46)	1.19 (0.76, 1.86)	1.13 (0.80, 1.60)
Sometimes (3–7)	1.29 (0.82, 2.04)	1.57 (0.89, 2.75)	0.95 (0.57, 1.57)
Often (8–39)	1.66 (0.96, 2.88)	1.43 (0.67, 3.04)	1.19 (0.65, 2.18)
Test for Trend	*0.065*	*0.11*	*0.68*
IPV and CA			
No or rare abuse	Ref	Ref	Ref
Severe CA only	1.47 (1.00, 2.15) *	0.78 (0.45, 1.36)	1.32 (0.90, 1.93)
Severe IPV only	1.20 (0.78, 1.86)	1.23 (0.73, 2.09)	0.90 (0.56, 1.43)
Severe CA and IPV	2.85 (1.56, 5.20) **	1.80 (0.81, 4.02)	1.62 (0.82, 3.22)

Adjusted OR is adjusted for age, education, and continuous parity

* P < 0.05;

** P <0.01