The role of childhood adversity and prenatal mental health as psychosocial risk factors for adverse delivery and neonatal outcomes: a prospective cohort study

Abstract

Objective. To examine the association between adverse childhood experiences (ACE), prenatal common mental disorders (PCMDs) and delivery and neonatal outcomes. Also, to examine the overall effect of ACE and individual ACE subcategories on PCMD diagnosis and obstetric outcomes.

Design. Prospective cohort study from pregnancy to birth.

Setting. The study was based on an Icelandic cohort study and supplemented with maternal childbirth records from three hospitals in Iceland.

Sample. Women recruited in the cohort study who had accessible childbirth records and singleton births (N = 522).

Methods. Bayesian SEM was used to test pathways between ACE, PCMD and delivery and neonatal outcomes with probit regression models.

Main outcome measures. ACE was assessed with a semi-structured interview. PCMD was diagnosed with the MINI+. Delivery outcomes were defined as pain management during labor and mode of delivery. Neonatal outcomes were defined as small for gestational age (SGA), preterm delivery (PD), Apgar score, fetal distress, and newborn intensive care unit (NICU) admissions.

Results. Women having experienced ACE were at increased risk of PCMD [β=.538, $p < .001$, CI: .195-1.154] and PD [β=.768, $p < .05$, CI: .279 - 1.007)]. An indirect association was found between ACE and increased risk of non-spontaneous delivery [β=.054, $p < .05$, CI: .004 - .152], mediated by PCMD. Identical findings were observed for individual ACE subcategories.

Conclusion. The negative impact of ACE on non-spontaneous delivery is mediated by the impact of ACE on PCMD diagnosis suggesting that interventions aimed at decreasing PCMD may reduce the risk of non-spontaneous delivery.

Tweetable abstract : Women exposed to adverse childhood experiences and diagnosis of prenatal common mental disorders are at increased risk of non-spontaneous delivery and preterm delivery. #prenatalmentalhealth #ace #delivery #neonatal

Keywords: prenatal mental health, childhood stressful life events, obstetric outcomes, cohort study, psychosocial risk factors.

Background / Introduction

Biomedical risk factors for poor obstetric outcomes are well established [1-3] but the available evidence on psychosocial risk factors is mixed and has faced methodological limitations [4-6]. Prenatal common mental health disorders (PCMD) include major depression (MD), anxiety disorders (AD), obsessive-compulsive disorder (OCD) and post-traumatic stress disorder (PTSD). MD and AD are considered the most prevalent mental health problems during pregnancy [7,8]. They are strong contributors to maternal morbidity and mortality [8-11], leading to a significant cause of global disease burden [12] and a high economic burden [13] if left untreated. Systematic reviews estimate prevalence for MD is around 12% [14,15] and 15% for AD [16] during the antenatal period, and risk factors include history of mental illness, low social support and exposure to adverse childhood experiences (ACE) [9,12,17-19]. ACE exposure includes emotional, sexual, and physical abuse, and/or living in a dysfunctional household before the age of 18 [20-22] and that living in poverty is a strong reinforcing factor and highly comorbid to ACE [23]. ACE exposure relates to long lasting adult psychopathology trajectories and poor physical health [22,24,25]. Studies show that women with a history of ACE or PCMD diagnosis are at increased risk of pregnancy complications [4,26], operative deliveries [27-29] and lower threshold for pain [4]. They are also at increased risk for poor neonatal outcomes such as

preterm delivery (PD), low birth weight (LBW) and small-for-gestational age (SGA) [5,30-33], that are linked to infant morbidity and mortality and associated with long and short term infant health problems and neurodevelopmental impairment [34-37].

Identification of high-risk women for PCMD is therefore important in antenatal care and understanding psychosocial risk for poor obstetric outcomes will help guide development for prevention and interventions. Our knowledge on the mechanisms driving the association between psychosocial risk factors and poor obstetric outcomes is still unclear, especially on the combined effect of multiple psychosocial risk factors. The study aims to examine the direct and indirect effects of ACE exposure and direct effects of PCMD on obstetric outcomes in Icelandic women (N=522). It is hypothesized that ACE exposure and PCMD relate to increased risk of epidural analgesia use during labor, non-spontaneous delivery, and poorer neonatal outcomes and that PCMD mediates the association between ACE and obstetric outcomes. ACE was examined both as one construct, as well as the individual effects of abuse and family dysfunction subcategories as the literature on this is sparse [38].

METHODS

Study design, study population, and data collection

This study's data were obtained from a previous prospective cohort study, *The Icelandic Study of Perinatal Mental Health (ISPMH)*. In the ISPMH study, a total of 2523 pregnant women completed screening instruments (Edinburgh Postnatal Depression Scale (EPDS)[39] and the Depression Anxiety and Stress Scales (DASS-42)[40]) at three time points, around 16, 25 and 36 gestational weeks. Those who screened positive on at least one occasion for depression and/or anxiety symptoms (EPDS (≥12), DASS depression ≥10 and/or DASS anxiety ≥ 8) together with one

in every four randomly selected participants that screened negative were invited to attend a diagnostic interview. A total of 560 women attended a diagnostic interview (*Mini International Neuropsychiatric Interview+ (MINI+)*[41] and their data was supplemented with available childbirth records (N=536), obtained from three hospitals in Iceland were they gave birth. Material and methods for the ISPMH study have been described in more detail previously [17,42].

For this study, data from participants who completed the MINI+ interview and who had available childbirth records are reported. Exclusion criteria were multiple births (as it affects delivery outcomes, n=9) and five women were excluded who had missing on all ACE questions (N=522).

Variables and measurements

Adverse childhood experiences (ACE)

A semi-structured interview, designed by the ISPHM group, was used to evaluate the ACE as no other instrument was available in Icelandic at the time [17]. Participants were interviewed by experienced clinical psychologists and psychiatrists and the interview contains questions on 11 types of ACE; *parental or siblings' death and parental divorce, serious mental illness, serious substance abuse, physical abuse, sexual abuse, being bullied, serious physical illness, serious accident, close friend or parent in serious accident, parent having a serious physical illness and living in great financial hardship or poverty*. Participants were asked to endorse (yes/no) whether a specific event occurred or not.

In this study, only two subcategories of ACE were used, a total of six questions. Two questions were used to measure *abuse* (sexual abuse and physical abuse) and four questions to measure *household dysfunction* (parental divorce, serious mental illness, serious substance abuse,

and poverty). To provide support for construct validity of our measure of ACE with two subcategories (abuse and household dysfunction), a confirmatory factor analysis was conducted with the Mplus 8.4 [43]. For model fit, conventional rules for categorical data were applied where good model fit is represented by the following fit indexes; RMSEA <.06, CFI ≥ .95, TLI ≥ .96 and SRMR <.90 are considered good model fit[144,45]. CFA results indicated a good fit for a two-factor model (household dysfunction and childhood abuse), RMSEA= .04 (CI90% .00 - .07), CFI= .98, TLI= .96, SRMR = .04.

Diagnosis of prenatal common mental disorders (PCMD)

The Mini-International Neuropsychiatric Interview Plus (MINI+) is a semi-structured diagnostic interview that contains 26 modules for the major axis I psychiatric disorders on the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV TR) and the *International Statistical Classification of Diseases 10th edition* (ICD-10) [41]. The diagnosis PCMD was used in this study and measured as a dichotomous variable (yes/no). PCMD are defined as major depressive disorder, dysthymia, generalized anxiety disorder (GAD), panic disorder, agoraphobia, social anxiety disorder, hypochondriasis, obsessive-compulsive disorder (OCD) and post-traumatic stress disorder (PTSD)[7]. The psychometric properties of MINI+ are good [41,46,47].

Multidimensional Scale of Perceived Social Support (MPSS)

The MPSS is a seven-point Likert-type scale of 12 items, ranging from "very strongly disagree" (1) to "very strongly agree (7) with a total score of 12-87. The scale has three subscales: *support*

[1] RMSEA = Root mean square error of approximation, CFI= Comparative fit index, TFI= Tucker Lewis Index, SRMR= standardized root mean square residual

from family, support from close friend and *support from a significant other*. Higher scores indicate more perceived social support [48] and the scale psychometric properties are good [49,50]. Internal reliability in this study was good (total score α= .94, significant other subscale α= .95, family subscale α= .91, friends subscale α= .93).

Delivery and neonatal outcomes

Delivery outcomes included pain management during labor and mode of delivery. Pain management during labor was measured with two binary variables: pharmacological pain management and epidural analgesia. Pharmacological medication was categorized as use of opioids and other pharmacological pain medications during labor. Delivery mode was measured with four binary variables: Spontaneous delivery (ICD-10: O80.0), non-spontaneous delivery (induction of labor (ICD-10: O83.8) or elective cesarean section (CS) (ICD-10: 082.0), emergency CS (ICD-10: 082.1) and instrumental delivery (i.e. encompassing forceps delivery (ICD: 081.5) or vacuum extraction (ICD-10: 081.4). Neonatal outcomes include small for gestational age (SGA), preterm delivery (PD), Apgar score, fetal distress, and newborn intensive care unit (NICU) admissions. Small for gestational age was measured by adjusting for gestational age and child gender by the use of Swedish national reference data [51]. SGA and PD were defined as dichotomous variables (10^{th} percentile, <37 weeks, respectively).

Analysis

Exploratory and descriptive analyses were conducted using IBM SPSS 25. Background data are presented descriptively; categorical data by frequencies (*n*) and proportions (%) and continuous

data with means and standard deviations (S.D.s). Bivariate analysis (i.e., Chi-square analysis and Mann-Whitney tests) were used to investigate differences in maternal demographics and reported ACE. For main modeling, path analysis in probit regression models with a Bayes estimation in Mplus 8.4 was used to examine the direct effects of ACE and PCMD and indirect effects of ACE on delivery and neonatal outcomes. Bayes estimation is used for more robust results with non-linear and missing data, complex models and recommended for small samples with binary outcomes and multiple mediators [52]. *Posterior Predictive P-value* (ppp-value) was used for model fit, and values < 0.5 indicates a good fit [53]. Only missing data was on ACE variables (<2%) and confounding variables (<1-2%).

Based on previous research [19], the following potential confounding factors were included in the analysis: Women's age, marital status education, employment status, current household financial status, Body Mass Index (BMI) and social support. When predicting delivery mode, medical complications was also included as possible confounding factor, i.e., women with a childbirth history that significantly increased the likelihood of childbirth induction or medical interventions during childbirth, i.e., women with gestational diabetes, hypertensive diseases, history of CS or other severe medical problems. For neonatal outcomes, delivery mode was also used as a confounding factor. The analysis was conducted in the following steps for each individual outcome variable: (a) a base model where each outcome is regressed on ACE and PCMD to examine direct paths, and indirect paths are examined between ACE and outcomes with PCMD as a mediator, (b) the same model was conducted while adjusting for confounding variables. All parameter estimates are reported with 95% C.I.s and p-values. Final models are presented with standardized coefficients and adjusted for confounding factors.

RESULTS

The characteristics of the women included in the study are presented in Table 1. Bivariate analysis showed that women exposed to ACE compared to those not exposed were significantly more likely to be single, have a lower education, be diagnosed with PCMD, experiencing their financial status as not good, and experience lower levels of social support.

Table 1 here

Of the 522 women included in this study, 322 (64%) reported being exposed to one or more childhood stressful life events, and 197 (38%) were diagnosed with one or more common mental disorders during pregnancy. Eighty-three (16%) were diagnosed with major depression, 101 (19.3%) with one or more an anxiety disorder (i.e., panic disorder, agoraphobia, social anxiety disorder,), 85 (16.3%) with GAD, 42 (8.1%) with OCD, 12 (2.3%) with hypochondriasis, 10 (2%) with dysthymia, and 6 (1.2%) with PTSD. Of those who were exposed to ACE, 144 (28 %) reported having parents separated or divorced, 144 (28%), lived in great financial hardship or poverty, 143 (28%), had been exposed to substance abuse, and 133 (26%) lived with a parent with mental illness, 117 (23%) reported being sexually abused, and 64 (12%) reported physical abuse.

The number and proportion for outcomes by total and separate adverse childhood experiences categories (abuse and household dysfunction) are shown in Table 2. Bivariate analysis showed that women exposed to ACE and women exposed to household dysfunction were more likely to

use pharmacological pain management and epidural analgesia during labor and to deliver preterm. Women exposed to abuse were more likely to deliver preterm (see Table 2).

Table 2 here

Effect of total ACE and PCMD on delivery and neonatal outcomes

The results of fit indices for all the Bayesian models showed a ppp-value lower than 0.5, indicating a good fit and all confounding variables were included in all final models. Results from path analysis revealed a significant direct effect of exposure to ACE on PCMD (β=.538, $p < .001$, CI: .195-1.154) in all models. Women exposed to ACE were at higher risk of being diagnosed with one or more PCMD (see fig. 1) and preterm delivery (β=.768, $p < .05$, CI: .279 - 1.007). Diagnosis of PCMD had a significant direct impact on higher risk of non-spontaneous delivery (β=.211, $p < .05$, CI: .022 - .402), and ACE had an indirect effect on increased non-spontaneous delivery (β=.054, $p < .05$, CI: .004 - .152) when mediated by PCMD. Other delivery and neonatal outcomes were not significantly directly or indirectly related to exposure to ACE or PCMD. Interestingly, ACE effects on pharmacological management and epidural analgesia during labor that were significant in the bivariate analysis are not significant when tested in the multivariate perspective of path analysis.

Fig 1 here

The individual effect of sexual and physical abuse

The individual effect of abuse was evaluated in a separate model for all outcomes with abuse as an individual predictor. All models showed a ppp-value lower than 0.5, indicating a good fit and final models were adjusted for confounding variables. Results indicated a direct association between PCMD diagnosis and increased non-spontaneous delivery (β=.206, p < .001, CI: 0.016 - 0.414) as an indirect effect of abuse on increased non-spontaneous delivery (β=.054, p < .001, CI: 0.002 - 0.170) when mediated by PCMD. Abuse also had a significant direct association with higher rates of preterm delivery (β=.748, p < .05, CI: .031 - 1.128). For other outcomes there was not a significant direct or indirect association with abuse or PCMD (see fig 2, supplementary material, appendix S1). Results from bivariate analysis and in the multivariate path analysis perspective are consistent.

The individual effect of household dysfunction

The individual effect of household dysfunction was evaluated in separate models for all outcomes with household dysfunction as an individual predictor. All models showed a ppp-value lower than 0.5, indicating a good fit, and final models were adjusted for confounding variables. Results indicate a direct association between diagnosis of PCMD and increased non-spontaneous delivery (β=.190, p < .05, CI: .025 - .358) and an indirect association between household dysfunction and increased non-spontaneous delivery (β=.033, p < .05, CI: .000 - .099). Household dysfunction was also directly related to higher rates of preterm delivery (β=.721, p < .05, CI: .255 - 1.010). For other outcomes, there was not a significant direct or indirect

association with household dysfunction or PCMD (see fig 3, supplementary material, appendix S2). As with the ACE total effect, significant effects between household dysfunction and pharmacological pain management and epidural analgesia during labor as shown in the bivariate analysis were not significant when tested in the multivariate perspective of path analysis.

Discussion

Main findings

First, we found that 64% of the women had experienced one or more types of ACE, of those, 58% reported living in a dysfunctional household and 29% reported abuse before the age of 18. Second, exposure to ACE is a strong predictor for the diagnosis of PCMD and preterm delivery, even after controlling for relevant confounders. Third, women diagnosed with PCMD were at higher risk of non-spontaneous delivery and exposure to ACE increased risk of non-spontaneous delivery, by the enhancement of PCMD diagnosis. The association remained after controlling for relevant confounding factors. Fourth, ACE subcategories household dysfunction and abuse, predicted the same outcomes, i.e. increase risk of preterm delivery directly and non-spontaneous delivery indirectly (mediated by PCMD). PCMD and ACE did neither have a significant direct or indirect association between other delivery or neonatal outcomes.

Strengths and limitations

The study has several strengths, including using clinical diagnostic interview to evaluate mental health during pregnancy and an interview conducted by experienced health professionals

evaluating adverse childhood experiences. Thus, providing a more robust measures as endorsement of ACE and symptoms of depression and anxiety tend to be overestimated when assessed with self-report screening tools [15,16,54]. The study is novel as it is a longitudinal design with a life course approach to early life stressors and adds considerable knowledge by examining multiple psychosocial risk factors on a broad range of obstetric outcomes that few studies have done so far. We also advance the literature by examining the effect of individual ACE types. It has been criticized that most ACE studies focus on a total cumulative score (i.e. a dose-response impact of each type of stressful life event), treating individual events equivalently regardless of severity [38,55]. This is problematic as higher cumulative scores often include more severe life events causing a more substantial impact [55] and recent studies indicate e.g., that maltreatment is a stronger predictor for PCMDs and poor obstetric outcomes than other ACE types [38,55-58].

The study also has some limitations, including sample size and diversity. The sample was relatively homogenous regarding age, ethnicity, and socio-demographic factors. However, the sample was representative for the Icelandic population, as it is a relatively small homogenous population. The study offers a reliable analysis of this specific group but should be interpreted with caution for other groups, and causality assumptions cannot be made. No information on the women who declined participation was available, hence no conclusions regarding selection bias could be made. ACE data are collected retrospectively, risking recall bias.

Interpretation

Our findings give support to a life course perspective of ACE affecting not only the mothers but their unborn children as well [18,19,24-26,59,60]. Consistent with a number of studies, our study shows

that ACE exposure as a total effect and as subcategories are significant predictors of PCMD diagnosis [17,38,56,61] and diagnosis of PCMD is a significant predictor for adverse delivery outcomes (i.e., non-spontaneous delivery) [27-29,62-64]. Our study also revealed that ACE exposure predicts preterm delivery [12,29,30,32,65,66], but ACE and PCMD did not predict other neonatal or delivery outcomes, consistent with previous studies [5,31,67]

Compared to a recent study by Wajid et al. [18], our findings are consistent, showing a high proportion of participants with at least one type of adverse experience during childhood (64%). Wajid et al. [18] revealed that the odds of experiencing depression during pregnancy are 2.5 times higher in women exposed to ≥ 4 types of adverse childhood experiences than those exposed to less than four types of adverse childhood experiences. Early childhood is known to be a sensitive period of development, and children exposed to traumatic life events or a dysfunctional family environment are subject to structural biological changes in their stress regulatory systems influencing the individual's future response with stress [25,68,69] and progressive studies show evidence of epigenetic alterations are one of the biological mechanisms that play a major role in the long-lasting effect of early life stress on adult psychopathology and physical health [24,70]. As pregnancy is a critical and sensitive period where women can experience profound physical and mental change, history of ACE could potentially trigger these problems in those women vulnerable to developing psychopathology [25,38]. The accumulating evidence that maternal psychosocial and physical stress during pregnancy can have long-term effects on child development is compelling. Studies show exposure to prenatal distress effects the fetus neuro- and brain development, child's cognitive abilities, development and psychopathology during childhood and through-out their lifespan [9,66,71,72]. Our findings show an indirect association between ACE and an increase in non-spontaneous delivery, and to our knowledge, these findings have not been reported

elsewhere. A recent study by Blackmore et al. [56] found a direct effect of clinically diagnosed anxiety and depression on low birth weight and exposure to traumatic events during childhood magnified the association. Our results are consistent with recent studies showing physical and sexual abuse as individual predictors for PCMD diagnosis and preterm birth [38,55]. However, inconsistent with previous studies, household dysfunction also proved to predict the same results as abuse. A possible explanation could be in our measurement of household dysfunction in a semi-structural interview opposed to self-report and we also included poverty as an item as it is a strong and persistent reinforcement factor to childhood adversity [23].

Interestingly, significant effects in bivariate analyses (i.e. between pain management variables and ACE) are not significant when tested in the multivariate perspective of path analysis. This suggests there is an underlying association between exposure to ACE and delivery outcomes, but other variables also play important roles in these relationships, consistent with previous studies [19,25]. This emphasizes the importance of future studies examining the effect of multiple psychosocial risk factors for poor obstetric outcomes.

Conclusion

Our findings indicate that women diagnosed with one or more PCMD are at risk for non-spontaneous deliveries and exposure to ACE is a strong predictor for mental health problems during pregnancy and preterm birth. The study extends the literature by examining the collaborative effect of multiple psychosocial risk factors (ACE and PCMD) on a wide range of delivery and neonatal outcomes. The clinical implications for the study are novel. By understanding psychosocial risk factors and identifying high-risk women, we can provide the

necessary information to develop better interventions in order to reduce these adverse outcomes. Thus, improving evidence-based guidelines for antenatal care, and early identification of women at risk may help decrease maternal and child health disparities and societal costs. To implement proper antenatal care for mother and child, obstetrical caregivers should be aware of psychosocial risk factors for poor childbirth and neonatal outcomes, especially exposure to ACE and its effect on the trajectories of psychopathology and physical health as an adult. Future studies should focus on identifying high-risk women with ACE and develop and test interventions aimed to reducing PCMD. Future studies should also examine further multiple psychosocial risk factors on obstetric outcomes and its complex interplay with biological mechanisms and confounding factors. Finally, future studies would also benefit from examining the relative contribution of different types of stressful life events and effect of onset age of exposure, severity of ACE and protective factors such as resilience and social support.

Disclosure of interests

The authors declare no conflicts of interest to the research authorship and or publication of this article.

Contribution to authorship

HK, JFS, HBV, RS, and TS contributed to the conception, design, analysis, interpretation of data and article writing. RS, SS and TS contributed to the analysis, interpretation of data, and article writing. SSJ contributed to the study by supplying the childbirth data. SSJ, LBL and HO participated in revising the manuscript and conducted *The Icelandic Study of Perinatal Mental*

Health (ISPMH) that this study is based on. Each author participated in revising the manuscript and approved the final submitted version.

Details of ethics approval

Approval for the study was received from the Icelandic National Bioethics Committee (ref. no. 05-107-S1 and VSN-15-135) and the Icelandic Data Protection Authority (ref. no. S2589).

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528 **Table 1.** Maternal demographic information, reported ACE of the participating women (n = 522) and
529 bivariate analysis.

530

		Reported adverse childhood experience (ACE)		
	Total (n=522) (n %)	No exposure to ACE (n=187) (n %)	Exposure to ACE (n=335) (n %)	p - value [a]
Age at enrollment, Mean (SD)	28.98 (5.08)	29.53 (4.82)	28.68 (5.20)	.065
Married/Cohabitating	472 (90.9)	178 (95.7)	294 (88.3)	.005
Education				.000
Primary	99 (19.4)	16 (8.6)	83 (25.5)	
Secondary	176 (34.4)	60 (32.4)	116 (35.6)	
University	236 (46.2)	110 (59.1)	127 (39.0)	
Employed (yes)	337 (66.3)	130 (71.8)	208 (63.4)	.055
Household financial status (good)	455 (87.5)	178 (95.7)	278 (83.0)	.000
PCMD diagnosis (yes)	197 (37.8)	49 (26.2)	148 (44.2)	.000
Medical complications (no)	451 (86.4)	161 (86.1)	290 (86.6)	.880
BMI index, Mean (SD)	30.93 (29.46)	29.83 (25.76)	32.05 (32.81)	.255
Social support, Mean (SD)	72.11 (11.32)	74.35 (10.34)	70.87 (11.65=	.001
Significant other	26.08 (3.59)	26.75 (2.97)	25.91 (3.71)	.094
Family	23.24 (4.93)	24.32 (4.17)	22.64 (5.20)	.000
Friends	22.79 (4.73)	23.60 (4.92)	22.35 (4.92)	.003
Primiparas	289 (55.5)	94 (50.5)	195 (58.2)	.102

532 [a] Two−sided bivariate test of independency.

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534

535 **Table 2.** Number of and proportion (%) of childbirth outcomes for women who reported exposure to
536 household dysfunction or physical or sexual abuse and bivariate analysis.

537

	Total sample (n=522) n (%)	Exposure to ACE (n=335) n (%)	p-value [a]	Household dysfunction (n=302, 58%) n (%)	p-value [a]	Abuse (n=149, 28.6%) n (%)	p-value [a]
Delivery mode and analgesia							
Pharmacological pain management	246 (47.2)	171 (51.0)	.016	155 (51.3)	.024	80 (53.7)	.058
Epidural analgesia during labour	231 (44.3)	161 (48.1)	.022	145 (48)	.047	75 (50.3)	.081
Spontaneous delivery	402 (77)	265 (79.1)	.128	239 (79.1)	.176	120 (80.5)	.226
Non-spontaneous delivery	135 (25.9)	81 (24.2)	.240	70 (23.2)	.101	39 (26.2)	.918
Emergency CS	43 (8.2)	25 (7.5)	.389	24 (7.9)	.777	10 (6.7)	.423
Instrumental delivery	36 (6.9)	24 (7.2)	.747	20 (6.6)	.772	10 (6.7)	.916
Neonatal outcomes							
Small for gestational age (SGA)	40 (7.7)	29 (8.7)	.263	28 (9.3)	.115	13 (8.8)	.561
Preterm delivery (PD)	17 (3.3)	15 (4.5)	.035	15 (5.0)	.010	9 (6.0)	.024
Apgar 1 min (Mean, (S.D.))	7.8 (1.57)	7.8 (1.53)	.534	7.83 (1.52)	.607	7.83 (1.67)	.774
Apgar 5 min (Mean, (S.D.))	9.2 (0.98)	9.28 (0.98	.679	9.28 (0.95)	.674	9.22 (1.05)	.314
Fetal distress	70 (13.4)	41 (12.2)	.293	38 (12.6)	.516	20 (13.4)	.996
NICU admission	49 (9.4)	30 (9.0)	.645	29 (9.6)	.847	14 (9.4)	.989

539 [a] Two−sided bivariate test of independency.

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