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Intimate partner violence, substance use, and adverse neonatal outcomes among urban women

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Abstract

Objective—To assess the prevalence of intimate partner violence, substance use, and their co-occurrence during pregnancy and examines their associations with adverse neonatal outcomes.

Study design—Between February 2009 and February 2010, pregnant women receiving obstetrical care at three urban clinics were screened for intimate partner violence and substance use between 24-28 weeks gestation. A chart review was conducted upon delivery to assess for adverse neonatal outcomes of low birth weight (LBW), preterm birth, and small for gestational age (SGA).

Results—Maternal and neonatal data were collected on 166 mothers and their neonates. Overall, 19% of the sample reported intimate partner violence during their pregnancies. Of the study's neonates 41% had at least one adverse neonatal outcome. Nearly half of the mothers reported using at least one substance during pregnancy. Women experiencing intimate partner violence had a higher prevalence of marijuana use than their non-abused counterparts ($p < 0.01$). Experiencing intimate partner violence was associated with a fourfold increase in having a SGA neonate (aOR = 4.00; 95% CI 1.58 – 9.97). Women who reported marijuana use had five times the odds of having a neonate classified as SGA (aOR = 5.16, 95% CI 2.24 – 11.89) or LBW (aOR 5.00; 95% CI 1.98 – 12.65).

Conclusions—The prevalence of intimate partner violence during pregnancy and substance use is high in urban mothers, the risks of which extend to their neonates. Pediatric providers are urged to routinely screen for both issues and recognize the impact of co-occurrence of these risk factors on poor neonatal and childhood outcomes.

Keywords

intimate partner violence; small for gestational age; substance use

Intimate partner violence is a public health issue existing in most countries, occurring across all demographic, ethnic, cultural and socioeconomic strata. Women of child-bearing age are at the highest risk for intimate partner violence, and pregnancy may represent a period of

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unique vulnerability to intimate partner violence due to changes in women's physical, social, emotional, and financial needs. Previous research has reported a wide range of prevalence of abuse during pregnancy (0.9%-20.1%),[1] though the majority of studies have found prevalence ranging from 3.9% to 8.3%.[2, 3] Variations in the prevalence of abuse during pregnancy are in part due to differences in the definition and measurement of intimate partner violence, study sample characteristics, and potential causal pathways.

Intimate partner violence during pregnancy confers considerable risk to the health of the woman and her unborn child. Low pregnancy weight gain, anemia, infections, bleeding in the first and second trimester, preterm labor, high blood pressure, edema, severe nausea, vomiting or dehydration, urinary tract infection, as well as hospital visits related to such morbidity are positively correlated with intimate partner violence.[4] Preterm birth, uterine rupture, hemorrhage, an infant requiring intensive care unit care, and maternal or fetal death are also associated with exposure to intimate partner violence during pregnancy.[5] There is a significant relationship between intimate partner violence during pregnancy and delivering a low birth weight (LBW) neonate.[4, 6] Meta-analyses of intimate partner violence-pregnancy studies found women experiencing intimate partner violence during pregnancy were at increased risk for preterm birth and delivering a LBW neonate.[7, 8]

There is a substantial impact of intimate partner violence on women's health behaviors during pregnancy, which, in turn, impact maternal and birth outcomes. Smoking is more common among abused pregnant women than their non-abused counterparts.[9, 10] Increased use of other illicit substances in pregnant women experiencing intimate partner violence also has been demonstrated.[11-13]

Research has examined a link between tobacco use and illicit drug use and adverse pregnancy outcomes, with divergent results. Tobacco use during pregnancy is associated with an increased risk of LBW, preterm birth and neonates who are small birth size for gestational age (SGA).[14-16] Studies of an association between marijuana use during pregnancy and adverse neonatal outcomes were inconclusive, with some studies reporting adverse effects including LBW, preterm birth and SGA[17], and other studies found no association.[18] The divergent findings may be in part due to a wide variation in reported prevalence of marijuana use as well as varied consideration of potential confounding variables across studies making comparisons difficult. The preponderance of evidence supports associations between the use of cocaine, crack cocaine, heroin, methamphetamine and LBW, preterm birth and SGA.[19-22]

Little is known regarding the manner in which the co-occurrence of intimate partner violence and substance use during pregnancy influences the growth rate of the fetus, as well as SGA is associated with increased rates of coronary heart disease, stroke, non-insulin dependent diabetes mellitus, adiposity, and metabolic syndrome in later life.[23-25]

Although limited, extant research has provided support for a relationship between intimate partner violence and risk of giving birth to a SGA neonate in developing countries.[26] Urquia et al[27] examined intimate partner violence during pregnancy and SGA in a Canadian population-based survey and did not find a relationship, perhaps due in part to the low reported prevalence of intimate partner violence during pregnancy (3.3%). Yet, experiencing intimate partner violence was associated with an increased risk of delivering a SGA neonate after adjusting for income and race/ethnicity in a sample of pregnant women in Vancouver, British Columbia (aOR 3.06, 95% CI 1.02-9.14), but the relationship did not hold after additional adjustment for alcohol, drug, or tobacco use.[28]

The purpose of this study was to examine the influence of intimate partner violence during pregnancy, tobacco use, and illicit substance use on adverse neonatal outcomes (eg, LBW,

SGA, preterm birth). By focusing on a group of women who are already at risk for health disparities in neonatal outcomes, we sought to provide further insight into possible avenues to address and mitigate any added risk for poor infant outcomes.

Methods

This prospective longitudinal study used a convenience sample of pregnant women recruited from three obstetrical clinics in Baltimore, Maryland. The three clinics were all affiliated with a major university health care system and served a predominantly low- socioeconomic, minority, urban population. Eligible participants were at least 16 years of age, spoke English as their primary language, and were between 24-28 weeks gestation at the time of data collection. Exclusion criteria included a history of fetal or infant death, use of tocolytic therapy prior to 28 weeks gestation, or a known chronic medical condition (eg chronic hypertension, preeclampsia diagnosed before 28 weeks, diabetes mellitus, clotting disorder). These exclusion criteria were assigned given their known contribution to adverse neonatal outcomes.[29, 30]

The study protocol and informed consent received institutional review board approval from the Johns Hopkins Medical Institutions. Eligible participants were approached about study participation during their prenatal care appointments. After a complete description of the study, informed consent was obtained and participants were interviewed in a private space with only the researcher and the participant present. The survey generally took 30-45 minutes to complete, and all women completed it during the wait-time for their appointments. Participants were compensated $15 for their participation.

Outcome measures related to neonatal outcomes were extracted from electronic chart review within 48 hours after delivery. Measures specific to maternal physical health risk factors (e.g. preeclampsia) were also extracted at this time, in case these developed after the initial time point of data collection (i.e. between 24-28 weeks gestation).

Of the 174 eligible pregnant women approached to participate, 167 (96%) completed the survey composed of field-tested instruments. One participant delivered at an outside hospital, which precluded the ability to obtain accurate birth outcomes. Thus, the final sample consisted of 166 low-income women and their neonates.

Outcome Variables

Outcomes of interest for this analysis pertained directly to neonatal outcomes which were obtained through an electronic chart review within 48 hours of delivery. Birth weight (grams) and gestational age (weeks) were taken directly from the chart. LBW was assigned if the neonate weighed < 2500 grams, and preterm birth was assigned if the neonate was born at <37 completed weeks of gestation. Intrauterine growth was then calculated by relating neonatal birthweight to the gestational age at birth against reference curves. We used comprehensive reference values of birth weight based on a national sample of over 6 million infants.[31] Gestational age was determined by ultrasound dating which was performed on every participant in the first trimester. An infant was considered SGA if intrauterine growth was less than 10% of the normal curve for his/her gestational age. The classifications of LBW, preterm birth, or SGA were not mutually exclusive, but each was analyzed as an adverse neonatal outcome.

Possible Correlates of Adverse Neonatal Outcomes

Data on sociodemographic variables including age, race, marital status, education and income were gathered. Total household annual income was dichotomized using the median of <$10,000 and >$10,000. Additional predictors for adverse neonatal outcomes included

maternal data specific to the current pregnancy as well as previous pregnancies. These included parity, number of term births, number of therapeutic and/or spontaneous abortions, number of live children, and presence of preeclampsia.

Another potentially predictive factor included substance use. Self-reported data was collected on: (1) cigarette smoking (or tobacco use); (2) marijuana use; and (3) crack cocaine, cocaine, methamphetamine, and/or heroin use since learning of the current pregnancy. Responses for each type (tobacco, marijuana, cocaine/methamphetamine/heroin) were dichotomized as "no use" or "use" during this pregnancy.

Experiencing physical partner violence during pregnancy was the final potential correlate evaluated for adverse neonatal outcomes. Participants answered the five items of the Abuse Assessment Screen (AAS).[32] Those responding "yes" to the question specifically asking about abuse *"since you've been pregnant"* were considered positive for intimate partner violence during pregnancy.

Data Analyses

All statistical analyses were performed using Stata 11 (StataCorp, College Station, TX). There were no missing data for this sample. We assessed internal consistency of the AAS (*Cronbach alpha* 0.87). Prior to analyses, multicollinearity of potential predictors was examined using the variance inflation factor (VIF), and tolerance. Results yielded a VIF ≤5 and tolerance ≥.2 suggesting that multicollinearity was not an issue in the data.[33] Chi-square and t-tests were used to test the bivariate associations between socio-demographic, maternal health factors during pregnancy, substance use and intimate partner violence variables and the outcome variables of LBW, preterm birth, and SGA. A series of generalized linear models were conducted and included variables that had p-values of less than 0.15 in bivariate analyses or were theoretically relevant. Adjusted odds ratios (AORs) and 95% confidence intervals (95% CI) were obtained from the logistic regressions. Final models were selected for best fit based on their Akaike Information Criterion values.

Results

The majority of the women (93%) identified themselves as African American. The average age was 23.3 years (5.43 SD). One-third of the women (33%) were primagravida. More than half (54%) of the women were single. Two-thirds (66%) of the participants had less than a high school diploma or equivalent, only 23% of the sample was employed at least part-time, and all had some form of health insurance including government subsidized insurance programs. Seventy-six women (46%) reported an annual income of less than $10,000.

Overall, adverse neonatal outcomes were common for the neonates in this study. There were 68 neonates (41%) who had at least one adverse outcome. LBW occurred in 35 (21%), and 23 (14%) were considered preterm. Forty-nine neonates (30%) were calculated to be SGA.

Maternal substance use varied in prevalence, depending on the type. Nearly half of the sample (n=81, 49%) reported using at least one substance during pregnancy. Of these women, 27 (16%) reported tobacco use, 64 (39%) reported marijuana use, and 18 (11%) reported cocaine, crack cocaine or heroin use during pregnancy.

Of the 166 women included in this analysis, 32 (19%) reported physical abuse during the current pregnancy. Certain sociodemographics and other predictor variables differed between abused and non-abused women (Table I).

Predictors of Adverse Neonatal Outcomes

Parity, number of term births, number of therapeutic and/or spontaneous abortions, and number of live children were not significantly related to adverse neonatal outcomes in bivariate analyses. Although thirteen women (7.8%) were diagnosed with preeclampsia, the presence of it was not statistically significantly related to an increased risk for an adverse neonatal outcome and did not contribute to the fit of the models.

Table II shows the risk factors for LBW, preterm birth or SGA in this sample of women and their neonates. There were no instances of LBW among women with the highest level of education (at least some college), and therefore, these 11 women were dropped from the final model. After adjusting for education, income, marital status, and substance use, experiencing intimate partner violence was associated with over five times increased odds for any adverse neonatal outcome (aOR 5.34; 95% CI 1.97 – 14.46) and specifically, a fourfold increase in having a SGA neonate (aOR = 4.00; 95% CI 1.58 – 9.97). Smoking was only predictive of increased risk for a LBW neonate (aOR 3.31; 95% CI 1.15 – 9.53). Those women who reported marijuana use during their current pregnancy were also at a 6-fold increased risk of having any adverse outcome and specifically five times the odds of having a neonate classified as SGA (aOR = 5.16, 95% CI 2.24 – 11.89) or LBW (aOR 5.00; 95% CI 1.98 – 12.65).

Discussion

In this low-income, urban sample, approximately 1 in 5 women reported physical abuse during their current pregnancies. This prevalence is consistent with the majority of research conducted among samples at increased risk for intimate partner violence (e.g. low-income, young, single, urban women).[32, 34] The prevalence of adverse neonatal outcomes (ie, LBW, preterm birth, SGA) was high in this sample, with 41% of study neonates experiencing at least one adverse outcome, and 21% of neonates classified as LBW. This is particularly concerning given many of the well-established risk factors for experiencing an adverse outcome were not evident in this sample (e.g. history of fetal or infant death, hypertension, diabetes mellitus). In population-based studies, African-American neonates are nearly twice as likely as their non-Hispanic White counterparts to be LBW (13.7% vs. 7.2%).[35] The prevalence of LBW in this sample was even higher though this sample was all low-income. This finding underscores the importance of further research on the most influential factors mediating the relationship between poverty and adverse pregnancy outcomes.

Substance use in pregnancy was associated with an increased risk of an adverse neonatal outcome. Consistent with other studies, tobacco use was associated with an increased risk of having a LBW neonate,[17] but was not associated with SGA in this study. Studies reporting associations between tobacco use and SGA have had larger sample sizes, a higher prevalence of tobacco use than noted in this sample, and data on time points in pregnancy when tobacco use occurred and levels of tobacco exposure.[14-16] Marijuana use was associated with an increased risk of having a neonate classified as either LBW or SGA, a finding consistent with recent research examining marijuana use and pregnancy outcomes.[17] Although our results suggest significant associations between marijuana use and LBW and SGA, uncontrolled confounding variables also may be contributing to these associations. For example, over 20% of women who reported marijuana use also reported tobacco use. Even though we adjusted for tobacco use in the multivariate analyses, we were not able to stratify the analysis due to limited numbers. Furthermore, urine screens for other illicit substances may have yielded a higher prevalence of use of other drugs (ie, crack, heroin, methamphetamines), as noted in several studies examining reliability of self-reported substance use during pregnancy.[17, 36] Nonetheless, our findings show a high prevalence of marijuana use during pregnancy and highlight the importance of health care providers

discussing the detrimental effects of marijuana use during pregnancy on maternal health, fetal growth, and neonatal outcomes. Although we relied on self-report measures, the women disclosed a fairly high rate of substance abuse. It may be that screening in a non-judgmental, supportive manner may facilitate disclosure. Furthermore, pediatric health providers are urged to support public health policies and approaches that emphasize education, treatment, and the provision of supportive services to substance-using pregnant women and new mothers.

Sixty-three percent of women experiencing intimate partner violence during pregnancy reported using marijuana during pregnancy, a significantly higher percentage than among non-abused women ($p<0.01$). Growing evidence supports substance abuse as both a risk factor and outcome associated with intimate partner violence[37, 38] and the co-occurrence disproportionately affects low-income women.[39, 40] The high prevalence of marijuana use noted among our participants may be related to women's attempts to self-medicate the physical and psychological pains of abuse during pregnancy. Given the links between intimate partner violence, substance use, and poor child health, our findings underscore the importance of screening for both issues during pediatric well-child visits in a nonjudgmental manner. There is overlap between intimate partner violence and childhood maltreatment; estimates ranging from 33% to 77%.[41] In response, the American Academy of Pediatrics has urged pediatricians to routinely screen for intimate partner violence as a way to prevent child abuse.[42] The role of the pediatric provider is particularly salient for these women given their frequent contact. Abused women are more likely to seek health care for their infants than non-abused women.[43] Thus, it is imperative that providers are equipped to offer the support and resources for intimate partner violence and its' negative sequelae on both women and children.[44]

A central finding of our research was the independent risk that intimate partner violence during pregnancy confers on an increased risk of delivering a SGA neonate, even after controlling for substance use. This may be related to the alterations in an abused mother's hypothalamic-pituitary-adrenal (HPA) axis related to the stress of abuse. Although the causes of SGA are not well understood, our understanding of potential mechanisms is expanding, largely due to animal research. Animal studies have shown that maternal exposure to stress during the perinatal period causes an increased sensitivity to induced HPA hormone secretion in the mother as well as in the offspring.[45] Higher circulating levels of maternal hypothalamic, pituitary, and placental hormones, including corticotrophin-releasing hormone (CRH), could activate labor as well as decrease utero-placental perfusion due to vasoconstriction in response to HPA activation.[46]

Although nascent, research has demonstrated that women experiencing intimate partner violence during pregnancy exhibit neuroendocrine changes similar to those seen in animal studies. Valladares et al[26] found Nicaraguan women experiencing intimate partner violence during pregnancy had higher cortisol levels which, in turn, were associated with both decreased gestational age and reduced birth weight at delivery. Other studies have identified associations between "stress" hormones (i.e., cortisol and ACTH) and preterm labor or elevated levels of CRH, though these studies did not measure intimate partner violence as a source of stress.[47-49] Further research on the neuroendocrine changes in pregnant women experiencing intimate partner violence is necessary to understand better the links between HPA activation, decreased utero-placental perfusion, and SGA. This is particularly germane given mounting research demonstrating the associations between being SGA at birth and having elevated risks for chronic diseases later in life.[23, 24, 50]

The present study has several limitations. First, the study's focus was on abuse during the current pregnancy using one measure. A more comprehensive abuse history, including

frequency and severity, might lead to an enhanced understanding of the associations between intimate partner violence and adverse neonatal outcomes. Second, substance use during pregnancy was assessed via self-report, which may have attenuated the prevalence. Also, an enhanced assessment of substance use including lifetime use and frequency might assist in explaining the associations evident in this sample. Additionally, we were unable to assess the independent risk that maternal depression has on adverse birth outcomes. We assessed for maternal depression in our survey using the Edinburgh Postnatal Depression Scale;[51] however, all but one of the women experiencing intimate partner violence during pregnancy in our sample also exceeded the cutoff for depressive symptomatology. This lack of variation prohibited our assessment of maternal depression on LBW, SGA, and preterm birth. A larger, more diverse sample in future research might provide enough dispersion to assess depression's role, independent of experiencing intimate partner violence. Finally, study findings are based on a convenience sample; thus, results can only be generalized to this sample. However, our findings support the need for an expanded study within and across racial and economic groups.

In conclusion, our data support the growing body of literature that demonstrates an association between intimate partner violence and adverse neonatal outcomes. The crucial finding of increased odds for an SGA neonate if a mother is abused during pregnancy needs further research. The cooccurrence of intimate partner violence and substance use and their contribution to adverse neonatal outcomes underscores the importance of appropriate screening and intervention for these vulnerable women and children. Early recognition and intervention is essential if we are going to make progress in reducing disparities in birth outcomes and long-term health outcomes for these neonates.

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Glossary

LBW	Low birth weight
SGA	Small birth size for gestational age

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Table 1

Socio-demographics characteristics of abused and non-abused women

	IPV negative 134 (81%)	IPV positive 32 (19%)	T-test/Chi-square/Fischer's exact test *p*-value
Age, mean (SD)	23.16 (5.26)	23.94 (6.15)	0.47
Race, n (%)			
African-American	125 (93)	30 (94)	0.80
White Non-Hispanic	7 (5)	2 (6)	
Other	2 (2)	0 (0)	
Education Level, n (%)			
<High School (HS)	84 (63)	26 (81)	0.14
HS grad/GED	40 (30)	5 (16)	
>HS	10 (7)	1 (3)	
Marital Status, n (%)			
Single	66 (49)	24 (75)	<0.01
Partnered/Married	67 (50)	6 (19)	
Other	1 (1)	2 (6)	
Annual Income			
<10,000 USD	53 (40)	23 (72)	<0.01
>10,001 USD	81 (60)	9 (28)	
Smoking, n (%)	23 (17)	4 (13)	0.52
Marijuana, n (%)	44 (33)	20 (63)	<0.01
Cocaine/Crack/Heroin/Methamphetamines, n (%)	13 (10)	5 (16)	0.33

Table 2

Factors influencing adverse neonatal outcomes in a convenience sample of women at three urban OB/GYN clinics

	Adverse Birth Outcome (Multivariate Logistic Regression)			
	Any (n=166) AdjOR, 95% CI*	**SGA (n=166) AdjOR, 95% CI***	**LBW (n=155^) AdjOR, 95% CI***	**PTB (n=166) AdjOR, 95% CI***
Education				
No HS diploma	(ref)	(ref)	(ref)	(ref)
HS diploma	1.17 (0.46 – 2.99)	1.17 (0.44 – 3.13)	0.38 (0.11 – 1.33)	0.52 (0.13 – 2.02)
At least some college	0.52 (0.07 – 3.67)	0.34 (0.03 – 4.11)	^	0.76 (0.08 – 7.57)
Annual Income	(ref)	(ref)	(ref)	(ref)
<10,000	0.77 (0.35 – 1.69)	0.63 (0.28 – 1.44)	1.03 (0.42 – 2.50)	0.75 (0.27 – 2.07)
>10,001				
Marital status	(ref)	(ref)	(ref)	(ref)
Single	1.72 (0.79 – 3.74)	1.70 (0.76 – 3.82)	1.07 (0.44 – 2.64)	1.58 (0.59 – 4.19)
Other				
IPV Exposure	(ref)	(ref)	(ref)	(ref)
No	**5.34 (1.97 – 14.46)**	**4.00 (1.58 – 9.97)**	2.21 (0.82 – 5.95)	2.15 (0.74 – 6.24)
Yes				
Smoking	(ref)	(ref)	(ref)	(ref)
No	1.72 (0.64 – 4.66)	0.91 (0.31 – 2.62)	**3.31 (1.15 – 9.53)**	1.35 (0.42 – 4.36)
Yes				
Marijuana Use	(ref)	(ref)	(ref)	(ref)
No	**5.94 (2.62 – 13.46)**	**5.16 (2.24 – 11.89)**	**5.00 (1.98 – 12.65)**	1.93 (0.71 – 5.26)
Yes				
Cocaine/Crack/Heroin Use	(ref)	(ref)	(ref)	(ref)
No	1.32 (0.39 – 4.45)	0.69 (0.21 – 2.25)	0.90 (0.28 – 2.88)	1.67 (0.74 – 5.87)
Yes				

*AdjOR = Adjusted Odds Ratios; 95% CI = 95% Confidence Intervals

^11 observations (highest education category) dropped because no instances of LBW in highest education category