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Intimate Partner Violence During Pregnancy and Adverse Neonatal Outcomes in Low-Income Women

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Abstract

Background: Intimate partner violence (IPV) affects an estimated 1.5 million U.S. women annually. IPV impacts maternal and neonatal health with higher rates of depression and low birth weight (LBW). Less studied is experiencing IPV and delivering a small for gestational age (SGA) baby. SGA neonates are at increased risk of developmental and behavioral problems. The negative sequelae persist into adulthood with increased rates of diabetes mellitus and coronary heart disease.

Methods: In a sample of 239 pregnant women experiencing IPV, in urban and rural settings, we examined cross-sectional associations of severity of IPV and neonatal outcomes (i.e., birth weight and gestational age). Severity of IPV was measured by the Conflict Tactics Scale 2 and neonatal outcomes were collected at the time of delivery.

Results: Outcomes were collected on 194 neonates; 14.9% ($n=29$) were classified as LBW, 19.1% ($n=37$) classified as SGA, and 9.8% ($n=19$) as LBW and SGA. Women reporting higher severity of IPV during pregnancy had a greater likelihood of delivering an SGA neonate (odds ratio [OR] 4.81; 95% confidence interval [95% CI] 1.86–12.47), and LBW neonate (OR 4.20; 95% CI 1.46–12.10).

Conclusions: In a sample of pregnant women experiencing perinatal IPV, women experiencing greater severities of IPV were more likely to deliver a neonate with an adverse outcome. Early recognition and intervention of IPV is essential to reduce disparities in birth outcomes and long-term health outcomes for these neonates.

Introduction

Intimate partner violence (IPV) is a global health issue affecting an estimated 1.5 million U.S. women each year.[1,2] A sizeable body of literature documents the substantial negative sequelae IPV imparts on a woman's physical and mental health.[3–5] Women of child-bearing age are at higher risk for IPV, and pregnancy represents a particularly vulnerable period for women in regard to physical and mental health consequences, as IPV may additionally affect pregnancy-related morbidity and neonatal health outcomes.[6,7] The adverse consequences of IPV during pregnancy on maternal health include poor pregnancy weight gain, anemia, infections, placental abruption, preterm labor, high blood pressure or edema, and severe nausea, vomiting, or dehydration.[7,8] Experiencing IPV during the perinatal period may confer risks to the neonate through the mother's increased risk of premature birth (PTB), as well as the infant being at risk for low birth weight (LBW), prolonged neonatal intensive care unit stays, and fetal death.[6,9–11] Less studied is the relationship between IPV during pregnancy and delivering a neonate classified as small for gestational age (SGA).

SGA (typically defined as a birth weight less than the tenth percentile, according to population birth weights)[12] is an adverse pregnancy outcome with significant negative consequences that may extend into adulthood. SGA is associated with increased mortality risk in the first year of life, in part related to the increased risk of PTB. Being born SGA is associated with lower cognitive ability and increased emotional, conduct, and attention deficit hyperactivity disorders.[13] Additionally, a growing body of research has demonstrated that SGA is associated with increased rates of coronary heart disease, stroke, noninsulin dependent diabetes mellitus, adiposity, and metabolic syndrome in later life.[14–16] Finally, limited research has demonstrated intergenerational effects of being born SGA; that is, women born SGA are

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noted to be at increased risk of delivering a SGA infant.[17] Additionally, women born SGA are also at an increased risk of developing preeclampsia and gestational diabetes.[17]

Limited research has examined the association of IPV during pregnancy and delivering a neonate classified as SGA with mixed results. Research conducted among a Canadian population-based survey of pregnant women did not find an association between IPV and delivering a neonate classified as SGA after adjusting for maternal age, marital status, ethnicity and socioeconomic status, perhaps due in part to the low reported prevalence of IPV during pregnancy (3.3%).[18] Yet, in another sample of pregnant women in Canada, experiencing IPV during pregnancy was associated with an increased risk of delivering a SGA neonate after adjusting for income and race/ethnicity (adjusted odds ratio [aOR] 3.06; 95% confidence interval [95% CI] 1.02–9.14). However, the relationship did not hold after additional adjustment for substance use.[19] The prevalence of SGA in these samples was 8.2% and 10.7%, respectively. In an urban, low-income sample of women in the United States, experiencing IPV during pregnancy was associated with a fourfold increase in having a SGA neonate (aOR = 4.00; 95% CI 1.58–9.97), after controlling for self-reported substance use.[20] The prevalence of SGA in this high-risk sample was nearly 30%, considerably higher than the $\sim$10% noted in normative samples in the United States.[21]

Taken together, these studies highlight the need to better understand the role that IPV may play in contributing to adverse neonatal outcomes, namely SGA. The purpose of this study is to examine the relationship between the severity of violence experienced during the perinatal period and delivering a neonate classified as SGA. Research demonstrates that low-income and minority women experience disparities in pregnancy outcomes, yet our understanding of contributing factors is incomplete. By focusing on a group of women experiencing IPV, we can elucidate potential pathways to address additional risk factors for poor neonatal outcomes.

Materials and Methods

The Domestic Violence Enhanced Home Visitation Program is a multistate longitudinal randomized clinical trial testing the effectiveness of a structured IPV intervention integrated into perinatal home visiting programs with a goal of reducing perinatal IPV.[22] This paper reports on data that were derived from the baseline assessment of this randomized clinical trial.

Procedures

The study protocol and informed consent received institutional review board approval from two participating academic institutions and participating rural and urban health departments. Additionally, a certificate of confidentiality was obtained from the U.S. National Institutes of Health. This was particularly important given the vulnerable population being studied; namely, low-income pregnant women reporting IPV.

Participants and Setting

Pregnant women were recruited from an urban East Coast health department and 12 rural midwestern health departments. Eligible partcipants were English-speaking women, <31 weeks gestation, reporting abuse within the last 12 months, and currently enrolled in a perinatal home visiting program of a participating health department. Women were screened for IPV with the Abuse Assessment Screen[23] and the Women's Experience in Battering scale to assess study eligibility.[24] During the baseline visit, which took place during pregnancy, women completed measures specific to experiencing violence during the perinatal period (i.e., the Conflicts Tactic Scale),[25] and maternal mental health (i.e., the Edinburgh Postnatal Depression Scale).[26] Upon delivery, women were contacted by study research nurses to obtain neonatal birth weight and gestational length and any pregnancy complications.

The sample size for the randomized control trial was determined *a priori* using existing published work demonstrating moderate effect sizes for changes in violence and resource use after 12 and 18 months respectively.[27] *A priori* power calculations demonstrated ample power (>0.80) with 40 participants in each of 4 groups ($n = 160$). This paper reports on baseline data only.

Study measures

Intimate partner violence. The Conflict Tactics Scale 2 (CTS2)[25] was used to measure IPV. The CTS2 assessed each woman's partners' use of a variety of violent behaviors to handle conflicts and was administered to women only. The instrument has five subscales (Negotiation, Psychological Aggression, Physical Assault, Sexual Coercion, and Injury). The total score for this study consists of summed items from all subscales except negotiation, as those six items measure acts used to settle disagreements. The total score was dichotomized at the median to classify ''low'' versus ''high.'' Subscale reliability ranged from 0.84–0.91, and the Cronbach's α for the total scale was 0.90.

Depressive symptoms. The Edinburgh Postnatal Depression Scale (EPDS), a well validated and widely used 10-item screening tool, was used to measure depressive symptoms.[26] This scale is brief and focuses less on somatic symptoms associated with depression than other instruments do, making it particularly valuable during pregnancy.[28] The scale has been used with ethnically/racially diverse women and with postpartum and nonpostpartum women, and several studies have supported its use during pregnancy.[29,30] This study used the most widely recommended cutoff score during pregnancy of >12 as indicative of clinically significant depressive symptoms. A sensitivity rate of 82% with a specificity of 95% has been previously demonstrated with this cutoff point in a similar population.[31] The Cronbach's α for the current study was 0.88.

Neonatal outcomes of interest for this analysis included the presence of LBW and SGA. LBW was assigned if the neonate weighed <2500 grams. Intrauterine growth was calculated by comparing neonatal birth weight with the gestational age at birth against comprehensive reference values of birth weight based on a national sample of over 6 million neonates.[32] A neonate was considered SGA if their intrauterine growth was less than 10% of the normal curve for its gestational age. The classifications of LBW and 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, income, and place of residence (urban versus rural) were collected. 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. Additional potentially predictive factors of adverse neonatal outcomes included illicit substance use as well as tobacco use. Self-reported data was collected on substance use during the current pregnancy. Research suggests that maternal depression during pregnancy may be in an important risk factor for LBW and SGA; thus, maternal depressive symptomatology was included as a covariate.[33,34]

Data analysis

Preliminary analyses examined sociodemographic variables and key study variables to assess distribution of data, and to identify potential outliers and collinearity among variables. T-tests and chi-square analyses were used for continuous and categorical variables respectively.

Adjusted odds ratios (aORs) and 95% confidence intervals (95% CI) were obtained from the logistic regressions. Model selection was based on statistical significance and use of Akaike's Information Criterion. The analyses presented here represent data collected at the delivery time point only.

Results

Demographic characteristics of sample

A total of 239 women were enrolled in the study during pregnancy. Six women delivered multiple births and 39 women were lost to follow-up at delivery; thus, neonatal outcomes (e.g., birth weight and gestational age) were collected on 194 neonates. The demographic characteristics of the study sample are demonstrated in Table 1. There were significant differences across location (i.e., urban vs. rural) for race and age, with the urban site enrolling a higher percentage of African American women (86%). Women from the urban site were older than women from the rural sites. There were no statistically significant differences across location for other key sociodemographic characteristics. The entire sample was low income and Medicaid eligible, a requisite for receiving home visiting services.

Adverse neonatal outcomes by location

The prevalence of adverse neonatal outcomes (i.e., LBW or SGA) across study location is presented in Table 2. In this sample, 29 (14.9%) neonates were classified as LBW, which is higher than the average LBW rate of 8.16 in the United States.[35] Further, 37 (19.1%) neonates were classified as SGA, and 19 (9.8%) of these neonates were both LBW and SGA. There were significant differences in neonatal outcomes by location, with urban women more likely to deliver a neonate classified as LBW or LBW and SGA.

Pregnancy-related variables (e.g., parity, number of term births, number of therapeutic and/or spontaneous abortions, number of live children, planned pregnancy) were not significantly related to LBW or SGA in bivariate analyses. Smoking and substance use were also assessed for their independent risk on adverse neonatal outcomes, and neither variable contributed to the fit of the models.

Maternal mental health was examined as a predictor of adverse neonatal outcomes. Overall, the mean score on the EPDS was 13.36 (standard deviation [SD] 6.25), and 129 (45.6%) of all study participants exceeded the cutoff score for depressive symptomatology. There were no statistical significant differences in EPDS scores by location. Severity of violence, as measured by the CTS2 during pregnancy, revealed a median score of 39.00 and a mean score of 46.64 (SD 35.61), with no statistically significant differences by location.

Table 1. Sociodemographic Characteristics of the Domestic Violence Enhanced Home Visitation Program Sample of Abused Women (N=239)

Characteristic	*Urban* (n=*92*) n *(%)*	*Rural* (n=*147*) n *(%)*	p
Age (years), mean (SD)	25.9 (5.1)	22.5 (5.1)	<0.001
Race			
African American	79 (86)	34 (23)	<0.001
White non-Hispanic	5 (5)	97 (66)	
American Indian/ Alaskan Native/other	8 (9)	16 (11)	
Education level			
<High school (HS)	38 (41)	61 (41)	0.704
HS grad/GED	20 (22)	39 (26)	
Some college/ trade school	21 (23)	33 (23)	
College/trade school graduate	13 (14)	14 (10)	
Marital status			
Single	72 (78)	110 (74)	0.527
Married	10 (11)	17 (12)	
Divorced	3 (3)	12 (8)	
Widowed/other	7 (8)	8 (6)	
Employment Status			
Unemployed	74 (80)	98 (66)	0.060
Part time	11 (12)	27 (19)	
Full time	7 (8)	22 (15)	
Government assistance			
Yes	81 (88)	132 (90)	0.798
No	11 (12)	15 (10)	

Table 2. Prevalence of Adverse Neonatal Outcomes by Location (N=194)

	Rural (n=*119*) n *(%)*	*Urban* (n=*75*) n *(%)*	*Chi-squared* p-value
SGA	20 (16.8)	17 (22.6)	$p=0.31$
LBW	9 (7.6)	20 (26.7)	$p<0.01$
SGA and LBW[a]	6 (5.0)	13 (17.3)	$p<0.01$

[a]The category ''SGA and LBW'' encompasses neonates also classified as small for gestational age (SGA) and low birth weight (LBW).

Table 3. Factors Influencing Adverse Neonatal Outcomes in a Convenience Sample of Women Experiencing Intimate Partner Violence

	SGA (N = 194) *AOR [95% CI]*	*LBW (N = 194)* *AOR [95% CI]*	*SGA and LBW (N = 194)* *AOR, [95% CI]*
Race			
Black	(ref)	(ref)	(ref)
White	0.91 [0.39–2.10]	**0.19 [0.06–0.59]**	0.38 [0.11–1.25]
Other	1.66 [0.45–6.09]	0.77 [0.19–3.12]	0.90 [0.17–4.70]
Education			
No HS diploma	**2.66 [1.11–6.39]**	2.52 [0.94–6.73]	2.41 [0.80–7.29]
HS diploma	1.30 [0.48–3.56]	1.28 [0.40–4.10]	0.83 [0.19–3.54]
At least some college	(ref)	(ref)	(ref)
Marital status			
Single	(ref)	(ref)	(ref)
Partnered	0.35 [0.08–1.60]	0.58 [0.15–2.25]	0.25 [0.03–2.11]
Other	0.62 [0.32–3.82]	0.41 [0.04–3.78]	0.46 [0.10–3.36]
Location			
Rural	(ref)	(ref)	(ref)
Urban	1.63 [0.69–3.82]	**3.88 [1.45–10.41]**	**4.37 [1.32–13.82]**
Depressive symptoms			
Low	(ref)	(ref)	(ref)
High	0.96 [0.44–2.12]	0.91 [0.38– 2.18]	1.02 [0.36–2.87]
IPV exposure			
Low severity	(ref)	(ref)	(ref)
High severity	**4.81 [1.86–12.47]**	**4.20 [1.46–12.10]**	**4.53 [1.23–16.63]**

Numbers in bold indicate statistical significance.
AOR, adjusted odds ratio; 95% CI, 95% confidence interval.

Adverse neonatal outcomes by severity of IPV

Analysis of CTS2 subscales demonstrated that 94.14% of women had at least one positive response to items on the psychological aggression subscale, 82% of women had at least one positive response to items on the physical assault subscale, 45% of women had at least one positive response to items on the sexual coercion subscale, and 62% of women had at least one positive response to items on the injury subscale. There was significant overlap in types of IPV reported by women, and less than 4% of the sample reported psychological aggression only.

Table 3 demonstrates the risk factors for a neonate being classified as LBW, SGA, or LBW and SGA in this sample of women experiencing IPV. After controlling for race, education, marital status, location, and depressive symptomatology, the severity of violence experienced during pregnancy was associated with over 4 times increased odds for all measured adverse neonatal outcomes. Specifically, comparing levels of violence exposure, women reporting high levels of violence had 4.81 times increased odds of delivering a neonate classified as SGA (aOR 4.81; 95% CI 1.86–12.47), 4.20 times increased odds of delivering a neonate classified as LBW (aOR 4.20; 95% CI 1.46–12.10), and 4.5 times the odds of delivering a neonate classified as both SGA and LBW (aOR 4.53; 95% CI 1.23–16.63) compared with women reporting low levels of violence. In this sample, women reporting less than a high school education were also at increased risk for delivering a neonate classified as SGA (aOR 2.66; 95% CI 1.11–6.39) compared with women with at least a high school diploma. Further, living in an urban environment was associated with an increased risk of delivering a neonate classified as LBW (aOR 3.88; 95% CI 1.45–10.41) and SGA and LBW (aOR 4.37; 95% CI 1.32–13.82). Depressive symptomatology was not associated with an increased risk of delivering a neonate with an adverse outcome.

Discussion

Disparities in neonatal outcomes

In this sample of low-income women experiencing IPV residing in urban and rural locations, the prevalence of adverse neonatal outcomes was high, with rates of LBW and SGA higher than seen in the general population.[36] This is consistent with research demonstrating that experiencing IPV during pregnancy is associated with a multitude of adverse pregnancy outcomes including LBW, PTB, and neonatal death.[19,37,38] IPV among minority populations, already at higher risk for adverse pregnancy outcomes, may contribute to disparities in pregnancy and neonatal outcomes evident among African American women. Indeed, in this study, women residing in the urban location were predominantly African American (86%) and delivered neonates classified as LBW or LBW and SGA at significantly higher rates than women living in the rural locations who were predominantly white (66%). Yet, there were not significant differences in levels of violence reported by location. The life course perspective suggests that birth outcomes are not only due to exposures during pregnancy; rather, they are influenced by an accumulation of exposures leading up to the pregnancy.[39] These findings necessitate a more comprehensive evaluation of the social determinants of health that may be associated with the multitude of stressors that low-income, minority women may be confronted with, as well as how the psychosocial stressors may influence biological pathways linking stress to pregnancy outcomes.

Women are exposed to a multitude of biopsychosocial experiences prior to pregnancy that impact maternal and neonatal health; thus, the role of health care providers in promoting positive outcomes should begin long before prenatal care is initiated. Approaching pregnancy care from a life course perspective necessitates that health care providers place greater emphasis on primary, preventive, preconceptional, and interconceptional care—fundamental aspects of women's overall health.[40] Further, to prevent the initiation of IPV, health care providers should focus discussions on healthy relationships across the lifespan, with a particular focus among pediatric and adolescent patients.

Severity of violence and adverse neonatal outcomes

The central finding of this analysis was that higher levels of reported violence conferred an increased risk of delivering a SGA neonate, even after controlling for depressive symptomatology. Higher levels of violence or the accompanying psychological stress may influence the hypothalamic pituitary axis hormones in ways yet understood. A sizeable body of animal studies demonstrates that exposure to chronic stress results in elevated basal cortisol levels and dysregulation of the hypothalamic–pituitary–adrenal (HPA) axis. Increased levels of hypothalamic, pituitary, and placental hormones could precipitate labor while also decreasing utero-placental perfusion due to vasoconstriction in response to HPA activation.[41] Our understanding of these mechanisms in human samples is limited. Valladares and colleagues found higher cortisol levels in women experiencing IPV which was associated with an increased risk of SGA.[42] Other studies have found associations between stress hormones (i.e., cortisol and adrenocorticotrophin-releasing hormone) and PTB, though IPV as a stressor was not specifically measured.[43–45] These findings highlight the need for further research on the neuroendocrine changes evident in pregnant women experiencing IPV. An enhanced understanding of the links between violence, HPA activation, utero-placental perfusion, and adverse neonatal outcomes may provide an important pathway to reducing disparities in neonatal outcomes. Additional research is needed to understand protective factors in women exposed to IPV. A careful assessment of a woman's perceptions of stress and the supports and resources available to her are key to promoting a healthy pregnancy.

The present study has several limitations. First, substance use during pregnancy was assessed via self-report. Very few participants reported smoking tobacco during pregnancy and no participant reported marijuana, crack cocaine, methamphetamine, or heroin use during the current pregnancy. Research has consistently demonstrated that substance use during pregnancy is associated with adverse neonatal outcomes.[46–48] Experiencing IPV may contribute to the adoption or reinforce behavioral coping mechanisms such as tobacco and illicit substance use that may influence birth weight and gestational age at birth.[49] Future studies may want to assess socially undesirable behaviors via audio computer-assisted survey instruments to decrease underreporting. Second, data on participants' own birth history (i.e., birth weight, gestational age) was not collected. Maternal birth weight has been shown to be correlated with offspring birth weight with one study demonstrating mothers who were SGA at birth had a 4.7-fold increase in SGA offspring.[50] Also, women in this study were enrolled in home visiting, requisite for study participation, both which may limit generalizability of study findings.

Conclusions

This paper supports the role of IPV in contributing to adverse neonatal outcomes, with women reporting a higher severity of violence at greater risk of delivering a neonate classified as LBW or SGA. Furthermore, women living in urban environments were more likely to deliver a neonate classified as SGA or LBW despite reporting similar levels of violence as their rural counterparts. While significant strides have been made in improving maternal and infant outcomes, we must be concerned and alarmed about the widening gap in disparities related to pregnancy outcomes. Racial disparities in neonatal outcomes have been a troubling problem for the last century. This calls for further research on how social determinants of health, along with maternal social disadvantage throughout the life course, affect inequalities in relation to pregnancy health and neonatal outcomes. A sizeable body of research highlights the close and inextricable link between maternal and newborn health.[51] IPV is a serious—and preventable—public health issue. Early recognition and intervention in women experiencing IPV is essential to improve the health of future generations of mothers and babies.

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