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# The Effects of Intimate Partner Violence Before, During, and After Pregnancy in Nurse Visited First Time Mothers

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**Abstract** To determine the prevalence of intimate partner violence (IPV) before, during and after pregnancy in a national sample of women enrolled in the Nurse Family Partnership (NFP); and, to determine correlates of IPV exposure. Clients enrolled in the NFP between 2002 and 2005 were selected. Data were extracted from NFP client encounter forms including demographic, health habits, family and relationships, and maternal and infant health information. IPV was measured by self-report and assessed during three time periods: 12 months prior to enrollment into the NFP program; during pregnancy up to 36 weeks; and, 12 months since the infant's birth. Multiple imputation methods were used to account for missing data; univariate, and multivariate analyses were conducted to determine characteristics of IPV exposure over time. IPV in the 12 months prior to pregnancy and at NFP enrollment was 8.1% (95% CI: 5.8–11.2%); 4.7% (4.3.0–5.1%) of women reported IPV during the first 36 weeks of their pregnancy; and, 12.4% (8.5–17.6%) of women reported IPV in the 12 months following delivery. Several IPV correlates were noted, including relationship status (having a partner before and after pregnancy, $p < 0.001$, $p = 0.023$, respectively), and maternal health and habits such as smoking (before, during and after pregnancy, $p < 0.001$, $p < 0.001$, $p = 0.001$, respectively). In longitudinal follow-up, reduced use of contraception following the birth of her infant, and rapid repeat pregnancy were significantly associated with IPV exposure. For NFP visited mothers, IPV prevalence is lowest during pregnancy, compared to periods before and after pregnancy. IPV had no demonstrable effect on perinatal outcomes such as gestational age, and birth weight; however, IPV was associated with lower rates of contraceptive use and higher rates of rapid repeat pregnancy in longitudinal follow-up.

**Keywords** Pregnancy · Intimate partner violence · Home visitation · Nurse

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## Introduction

### Intimate Partner Violence During Pregnancy

Violence by an intimate partner has significant health and social consequences for women in the U.S. and internationally [1–7]. The perpetration of intimate partner violence (IPV), defined as a pattern of behaviors that are coercive or assaultive in nature, and manifests as the threats of direct physical, sexual or psychological abuse which exerts control and intimidation over the victim, has been well described [7–12]. An estimated 4.8 million IPV incidents occur annually in the U.S. in women 18 years and older [13].

The prevalence of IPV during pregnancy has been reported as 4–9%, with younger age, single or divorced relationship status, minority race/ethnicity, poverty, and other stressful life events, as factors associated with higher rates [10, 11, 14–17]. Risks of internalizing disorders such

as post traumatic stress syndrome, depression, and anxiety have been noted in women who have experienced IPV; however, the lasting effects of chronic stress due to IPV exposure can continue post-natally and result in continued functional limitations for the mother and her infant [1, 5, 13, 18, 19]. The inherent risks of IPV to the fetus have generated additional attention with negative perinatal outcomes observed. Specifically, preterm birth [7, 20], and low gestational weight [21], have been demonstrated as additional adverse consequences of IPV during this particularly vulnerable period for women.

It is unclear whether women who are pregnant are at greater risk of IPV [22, 23], with some studies demonstrating substantial rates of IPV during pregnancy. Other studies, however, have shown much lower rates with estimates of IPV 12 months prior to birth, including the pregnancy period, ranging from 1 to 34% [22, 24]. Concerns regarding the timing of administration of IPV screening measures, and variability in subject agreement regarding which behaviors constitute IPV [24] have been identified as limitations in accurately determining the prevalence of IPV during pregnancy. Before effective interventions can be developed to address this problem and modify its risks during pregnancy, a clearer understanding of the prevalence across this reproductive health cycle seems warranted.

### Home Visiting as an Intervention to Address IPV

Home visitation, a process of engagement between provider (nurse, social worker paraprofessional), and client (parent and child) in the home environment, has been utilized to support families for many years, with some of the earliest efforts made by public health nursing. The overarching goal of this intervention has been to improve parent and child health. In specific, home visitation has been shown to reduce child maltreatment towards children when clients engage with home visitors [25–31]. However, the effectiveness of home visitation in reducing maternal IPV experiences has been only recently the subject of current research [32, 33]

In follow-up studies of these cohorts, sustained child and maternal benefits were realized by the participants such as reducing preterm and low-weight births; increased use of well child visits; and reductions in hospitalizations for injuries and ingestions (proxy measures for home environment safety) [34, 35]. Efforts in developing greater effectiveness in child maltreatment prevention in homes where domestic violence exists are ongoing, as the goal of reducing child maltreatment was noted to be attenuated in those homes [32].

The purpose of this study was to determine the prevalence of IPV before, during and after pregnancy in a national sample of women enrolled in the Nurse Family Partnership; and, to determine correlates associated with IPV exposure. We hypothesized that the pregnancy period was protective of IPV exposure to women who engaged in nurse home visits, based upon reports of IPV exposure prior to being pregnant, during pregnancy, and 12 months following delivery. Additionally, we hypothesized that this cohort of women who reported IPV prior to and during pregnancy, have increased risk for adverse maternal and perinatal outcomes.

## Methods

### Sample

Eligible clients included in this study over the time period of 2002–2005 were identified using the Nurse Family Partnership Program Computerized Information System (CIS). The NFP program is a targeted intervention to first time, low income mothers. Low income is based upon the individual site's definition, and is categorized as a percent below the national poverty level. This is often implemented through Medicaid eligibility in the specific state that the NFP site is located, and can be variable i.e., 150–200% below the federal poverty level to qualify for Medicaid.

Clients were included in this database if they were enrolled in the NFP and were not part of a statewide NFP implementation, as those sites utilized state-specific data systems and were not part of the CIS. Data for each client were extracted from six NFP forms (Client Intake, Demographics, Health Habits, Family and Friends, Maternal Health, and Infant Forms). The main part of the analysis included all clients with information in the client intake form that identified them as being at least 13 years old at time of enrollment, and as having given birth at least 12 months before October 2005, to ensure that IPV information could have been collected at the scheduled 12-month infancy visit. Analysis of variables that would have been collected at the 24-month infancy visit were further restricted to women whose infant was born at least 24 months before October 2005.

### Measures

We were interested in evaluating IPV exposure in the context of women who enrolled in NFP. IPV exposure was measured using two items from the Abuse Assessment Screen (AAS) [36] and was used as part of the standard NFP intervention. The AAS is a five item measure developed to assess IPV against pregnant women [37]. Its initial psychometric testing occurred on predominantly, young, low income women, making it a suitable tool for this project.

First, "IPV in the last year" was defined as those women who, at the time of NFP enrollment, self-identified as being physically hurt by their husband, ex-husband, boyfriend, or ex-boyfriend in the 12 months before enrolling in NFP. Second, "IPV since enrollment up to 36 weeks gestation" was defined as those women who at the time of the 36 week visit self-identified as being physically hurt by their husband, ex-husband, boyfriend, or ex-boyfriend during their pregnancy and since NFP enrollment. Third, "IPV in the 12 months after pregnancy" was defined as those women who report IPV exposure at the infant's 12 month assessment and was specific to IPV experiences since the birth of the infant. These measures allowed us to compare baseline prevalence of IPV (in the last year), to IPV that the respondent has identified as occurring during the pregnancy period, to IPV experiences within the 12 months following delivery.

Maternal affect was measured using the short version of the Rand Mental Health Screen, where smaller values reflect a healthier affect [38]. Maternal beliefs and coping patterns and behaviors were measured using Pearlin's Sense of Mastery Scale, where smaller values reflect less healthy states [39]. All other variables were measured by self-report to the RN in the context of regularly scheduled home visits with her client and longitudinally during the course of parent engagement with the NFP program.

### Analysis

Data were analyzed using R version 2.12.1. For the purposes of missing data analysis, engagement with the NFP program was measured with counts of missing data collection forms at baseline and during scheduled follow-up. Multiple imputation (MI) with 5 imputations was used to adjust for missing data, where the MI models included both engagement with the NFP program and all the analyzed variables to estimate the distribution of missing values. All analyses are based on MI-pooled linear regression models for continuous variables and MI-pooled logistic regression models for categorical variables, as implemented in the MICE package version 2.2. Bivariate analyses to evaluate potential factors associated with IPV used the IPV variable as the independent variable. Multivariate analyses were conducted with dependent IPV variables adjusted for clinical and demographic characteristics associated with IPV exposure. Longitudinal analyses were conducted using only the baseline and 12-month post-delivery IPV measurements, since these questions covered the same amount of time, and were conducted using mixed-effects logistic regression analysis.

This study was approved by our hospital's investigational review board and the Nurse Family Partnership National Service Office Research Review Committee.

## Results

### Demographic Characteristics

There were 10,855 subjects included in the study. Estimated demographic characteristics of the study population are reported in Table 1. Maternal age at time of NFP enrollment ranged up to 45 years with a mean (SD) of 19.9 years (4.1). Most mothers (55.0%) were between the ages of 18–25 years. The predominant race/ethnicity that women reported was: white, non-Hispanic (43.6%); black, African-American (25.1%); and Hispanic/Latina (27.6%). Almost 80% of mothers reported being involved with a current partner (boyfriend, married or separated) at the time of enrollment and 14.6% having ever been married. However, 38.5% of mothers reported living with their partner at enrollment. Less than half of the study population (41%) had a high school diploma (or equivalent). The majority (69.2%) of mothers were receiving Medicaid. Less than 4% of mothers reported using alcohol, marijuana, cocaine or other street drugs in the last 14 days and 36.1% reported smoking cigarettes during their pregnancy. Prenatal care was started at a mean of 9.3 weeks with most (84.0%) of mothers beginning to receive prenatal care in the first trimester. The mean infant gestational age and birth weight were 38.8 weeks, and 3,152 g, respectively. There were 10.7% of infants with low birth weight and 13.3% required admission to a NICU.

### Estimated Longitudinal IPV Prevalence

We estimate that IPV in the 12 months prior to pregnancy and NFP enrollment was 8.1% (95% CI: 5.8–11.2%). Longitudinally, 4.7% (4.3.0–5.1%) of women reported IPV during the first 36 weeks of their pregnancy. IPV reported in the 12 months following delivery (12.4% (8.5–17.6%) was larger than the baseline annual rate, but this difference was not significant ($p = 0.170$).

### Correlates of IPV Experiences

While IPV exposure was associated with higher maternal age before pregnancy, mothers experiencing IPV at 12 months following pregnancy were significantly younger than their counterparts living without IPV ($p = 0.026$, $p < 0.001$, respectively). There was variability in the racial and ethnic make-up of the mothers who reported IPV exposure across time. White Non-Hispanic mothers were consistently over-represented among those who experienced IPV, reaching statistical significance in the year before NFP enrollment, and for the 12 months after delivery ($p < 0.001$, $p = 0.009$. respectively). Black/African-Americans were also over-represented among

**Table 1** Population characteristics and IPV exposure before, during and after pregnancy (effect size = odds ratio for categorical variables, difference in means for continuous variables)

| Characteristic | All | IPV in 12 months before enrollment | | IPV since enrollment up to 36 weeks gestation | | IPV in 12 months after pregnancy | |
|---|---|---|---|---|---|---|---|
| | Estimate [*n* not imputed] | Yes Estimate Effect size (*p*) [*n* not imputed] | No Estimate | Yes Estimate Effect size (*p*) [*n* not imputed] | No Estimate | Yes Estimate Effect size (*p*) [*n* not imputed] | No Estimate |
| Maternal demographics | | | | | | | |
| Age | 19.9 | 20.3 | 19.9 | 19.6 | 19.9 | 19.1 | 20.0 |
| | | 0.393 | | −0.302 | | −0.947 | |
| | | (0.026) | | (0.296) | | (<0.001) | |
| | [10,855] | [9,477] | | [9,137] | | [5,824] | |
| White Non-Hispanic | 43.6 | 53.7 | 42.7 | 45.3 | 43.6 | 48.2 | 43.0 |
| | | 0.609 | | 0.517 | | 0.552 | |
| | | (<0.001) | | (0.593) | | (0.009) | |
| | [10,303] | [9,394] | | [8,960] | | [5,596] | |
| Black/African American | 25.1 | 26.9 | 25.0 | 26.3 | 25.1 | 24.6 | 25.2 |
| | | 0.525 | | 0.516 | | 0.492 | |
| | | (0.453) | | (0.676) | | (0.726) | |
| | [10,303] | [9,394] | | [8,960] | | [5,596] | |
| Hispanic/Latina | 27.6 | 17.5 | 28.5 | 25.6 | 27.7 | 23.7 | 28.1 |
| | | 0.347 | | 0.474 | | 0.443 | |
| | | (<0.001) | | (0.506) | | (0.120) | |
| | [10,294] | [9,394] | | [8,959] | | [5,592] | |
| Has a partner at NFP enrollment | 79.0 | 68.2 | 79.9 | 80.4 | 78.9 | 83.1 | 78.4 |
| | | 0.350 | | 0.523 | | 0.575 | |
| | | (<0.001) | | (0.571) | | (0.023) | |
| | [10,266] | [9,363] | | [8,929] | | [5,576] | |
| Live with partner at NFP enrollment | 38.5 | 26.4 | 39.6 | 37.7 | 38.6 | 36.0 | 38.9 |
| | | 0.354 | | 0.490 | | 0.470 | |
| | | (<0.001) | | (0.789) | | (0.339) | |
| | [10,232] | [9,340] | | [8,901] | | [5,560] | |
| Medicaid enrollment | 69.2 | 73.4 | 68.8 | 75.0 | 69.1 | 69.6 | 69.1 |
| | | 0.556 | | 0.573 | | 0.506 | |
| | | (0.007) | | (0.067) | | (0.828) | |
| | [10,303] | [9,394] | | [8,960] | | [5,596] | |

**Table 1** continued

| Characteristic | All | IPV in 12 months before enrollment | | IPV since enrollment up to 36 weeks gestation | | IPV in 12 months after pregnancy | |
|---|---|---|---|---|---|---|---|
| | Estimate [*n* not imputed] | Yes Estimate Effect size (*p*) [*n* not imputed] | No Estimate | Yes Estimate Effect size (*p*) [*n* not imputed] | No Estimate | Yes Estimate Effect size (*p*) [*n* not imputed] | No Estimate |
| Substance abuse in last 7 days (alcohol, marijuana, cocaine or other drugs) | 3.6 | 9.6 | 3.0 | 9.0 | 3.5 | 4.7 | 3.4 |
| | | 0.774 | | 0.733 | | 0.583 | |
| | | (0.017) | | (0.001) | | (0.199) | |
| | [9,912] | [9,236] | | [8,767] | | [5,461] | |
| Cigarette use in last 48 h | 36.1 | 59.2 | 34.1 | 51.6 | 35.7 | 50.9 | 34.0 |
| | | 0.738 | | 0.657 | | 0.668 | |
| | | (<0.001) | | (< 0.001) | | (0.001) | |
| | [9,540] | [9,020] | | [8,529] | | [5,261] | |
| Positive affect | 11.9 | 13.6 | 11.7 | 14.1 | 11.8 | 12.9 | 11.7 |
| | | 1.854 | | 2.284 | | 1.145 | |
| | | (<0.001) | | (<0.001) | | (<0.001) | |
| | [10,234] | [9,337] | | [8,923] | | [5,565] | |
| Personal belief | 21.6 | 21.0 | 21.7 | 20.4 | 21.6 | 21.2 | 21.7 |
| | | −0.614 | | −1.225 | | −0.514 | |
| | | (<0.001) | | (<0.001) | | (<0.001) | |
| | [10,182] | [9,292] | | [8,882] | | [5,539] | |
| Prenatal care (weeks) | 9.3 | 8.9 | 9.4 | 8.9 | 9.3 | 9.3 | 9.3 |
| | | −0.408 | | −0.469 | | −0.010 | |
| | | (0.213) | | (0.220) | | (0.956) | |
| | [10,208] | [9,305] | | [8,891] | | [5,545] | |
| Perinatal outcomes | | | | | | | |
| Gestational age (weeks) | 38.8 | 38.6 | 38.8 | 38.5 | 38.8 | 38.7 | 38.8 |
| | | −0.238 | | −0.252 | | −0.152 | |
| | | (0.068) | | (0.157) | | (0.415) | |
| | [10,632] | [9,361] | | [9,033] | | [5,722] | |
| Preterm (<37 weeks) | 10.3 | 11.0 | 10.2 | 12.2 | 10.2 | 11.1 | 10.2 |
| | | 0.519 | | 0.550 | | 0.523 | |
| | | (0.621) | | (0.326) | | (0.549) | |
| | [10,632] | [9,361] | | [9,033] | | [5,722] | |

**Table 1** continued

| Characteristic | All | IPV in 12 months before enrollment | | IPV since enrollment up to 36 weeks gestation | | IPV in 12 months after pregnancy | |
|---|---|---|---|---|---|---|---|
| | Estimate [*n* not imputed] | Yes Estimate Effect size (*p*) [*n* not imputed] | No Estimate | Yes Estimate Effect size (*p*) [*n* not imputed] | No Estimate | Yes Estimate Effect size (*p*) [*n* not imputed] | No Estimate |
| Low birth weight (≤2,500 g) | 10.7 | 12.3 | 10.6 | 11.0 | 10.7 | 11.6 | 10.6 |
| | | 0.544 | | 0.509 | | 0.527 | |
| | | (0.147) | | (0.863) | | (0.622) | |
| | [10,740] | [9,449] | | [9,117] | | [5,778] | |
| NICU admission | 13.3 | 14.6 | 13.2 | 16.0 | 13.3 | 14.7 | 13.1 |
| | | 0.530 | | 0.555 | | 0.533 | |
| | | (0.437) | | (0.224) | | (0.290) | |
| | [10,250] | [9,180] | | [8,873] | | [5,537] | |
| Postnatal outcomes | | | | | | | |
| *Contraceptive use 6 months after initial pregnancy | 69.0 | 64.5 | 69.4 | 64.3 | 69.2 | 56.4 | 72.7 |
| | | 0.445 | | 0.445 | | 0.326 | |
| | | (0.083) | | (0.306) | | (0.016) | |
| | [4,337] | [3,766] | | [3,760] | | [3,271] | |
| *Contraceptive use 6–12 months after initial pregnancy | 57.4 | 55.8 | 57.5 | 51.0 | 57.6 | 39.7 | 62.7 |
| | | 0.483 | | 0.434 | | 0.282 | |
| | | (0.560) | | (0.168) | | (0.018) | |
| | [3,548] | [3,084] | | [3,081] | | [3,359] | |
| *Contraceptive use 12–18 months after initial pregnancy | 59.2 | 55.2 | 59.6 | 54.2 | 59.4 | 48.1 | 62.4 |
| | | 0.455 | | 0.447 | | 0.358 | |
| | | (0.265) | | (0.208) | | (0.037) | |
| | [2,935] | [2,531] | | [2,553] | | [2,723] | |
| *Contraceptive use 18–24 months after initial pregnancy | 60.0 | 61.1 | 59.9 | 54.8 | 60.2 | 47.7 | 63.5 |
| | | 0.512 | | 0.445 | | 0.344 | |
| | | (0.721) | | (0.412) | | (0.001) | |
| | [2,622] | [2,277] | | [2,290] | | [2,440] | |
| *Pregnancy within 6 months of initial pregnancy | 12.9 | 17.7 | 12.5 | 17.9 | 12.7 | 25.4 | 9.1 |
| | | 0.602 | | 0.600 | | 0.774 | |
| | | (0.003) | | (0.516) | | (0.014) | |
| | [4,200] | [3,657] | | [3,647] | | [3,162] | |

**Table 1** continued

| Characteristic | All | IPV in 12 months before enrollment | | IPV since enrollment up to 36 weeks gestation | | IPV in 12 months after pregnancy | |
|---|---|---|---|---|---|---|---|
| | Estimate [*n* not imputed] | Yes Estimate Effect size (*p*) [*n* not imputed] | No Estimate | Yes Estimate Effect size (*p*) [*n* not imputed] | No Estimate | Yes Estimate Effect size (*p*) [*n* not imputed] | No Estimate |
| *Pregnancy within 12 months of initial pregnancy | 31.2 | 34.0 | 30.9 | 38.6 | 30.9 | 57.7 | 23.1 |
| | | 0.536 | | 0.585 | | 0.820 | |
| | | (0.286) | | (0.367) | | (0.009) | |
| | [3,444] | [2,994] | | [2,994] | | [3,261] | |
| *Pregnancy within 24 months of initial pregnancy | 45.4 | 49.0 | 45.0 | 45.1 | 45.4 | 68.5 | 38.4 |
| | | 0.540 | | 0.497 | | 0.777 | |
| | | (0.457) | | (0.981) | | (0.013) | |
| | [2,559] | [2,219] | | [2,232] | | [2,379] | |

* Includes only those clients who delivered their infant early enough that their baby could be 24 months at the data cut-off for this study

those who experienced IPV, but this difference did not reach significance. Finally, Hispanic/Latina mothers are consistently under-represented among those who experience IPV, where the difference is statistically significant for the pre-enrollment period ($p < 0.001$).

Relationship status at NFP enrollment was related to reported IPV exposure. There were fewer mothers who reported having a partner at NFP enrollment among those experiencing IPV before enrollment ($p < 0.001$), although this finding was reversed longitudinally. That is, those experiencing IPV 12 months post-delivery were more likely to have had a partner at enrollment than their violence-free counterparts ($p = 0.023$). Additionally, we observed the same pattern for living with a partner at the time of NFP enrollment. Additional analyses (Table 2) demonstrate that, longitudinally, fewer women reporting IPV have a partner at the time they report the violence than their counterparts not reporting IPV. Again, a similar trend was observed in those subjects living with a partner.

Maternal health and habits were notably associated with IPV exposure. Substance use and cigarette use were both significantly associated with IPV exposure throughout the continuum of NFP intervention ($p < 0.001$) except during the 12 months following delivery where there was no difference in substance use. A mother's mental health at NFP enrollment was noted to be significantly related to IPV exposure throughout the study period. Both positive affect and personal belief scales were significantly worse among those reporting IPV across all time points ($p < 0.001$).

## Perinatal and Postnatal Outcomes of IPV Experiences

Perinatal outcomes including gestational age, prematurity, low birth weight, and admission to the NICU were not significantly associated with IPV throughout the study, with only a slightly lower average birth weight (3,036 g vs. 3,155 g, $p = 0.003$) in mothers reporting IPV during pregnancy.

A total of 6,414 women who were enrolled in the program, delivered their first infant 24 months before the study cut-off. Contraception use at 24 months after the first pregnancy was negatively associated with IPV exposure 12 months after delivery, with fewer women actively engaged in preventing a subsequent pregnancy compared to those women who were not experiencing IPV ($p = 0.001$). These women were also more likely to experience a pregnancy within 24 months of the birth of the first child ($p = .013$). Reports of prior IPV were not significantly related to these 24-month outcomes.

There were no differences between those women experiencing IPV and those who were not reporting IPV with regard to their extent of participation within the NFP intervention as measured by the number of missing forms.

**Table 2** Partner status and IPV exposure before, during and after pregnancy

| Partner status | All % (*n*) | IPV in 12 months before enrollment | | IPV in 12 months after pregnancy | |
|---|---|---|---|---|---|
| | | Yes | No | Yes | No |
| Currently has a partner (at enrollment) | 79.0 | 68.2 | 79.9 | 83.1 | 78.4 |
| | | (<0.001) | | (0.023) | |
| | [10,266] | [9,363] | | [5,576] | |
| Currently has a partner (at infant 12 months) | 74.4 | 66.4 | 75.1 | 66.6 | 75.5 |
| | | (0.002) | | (0.013) | |
| | [6,013] | [5,387] | | [5,679] | |
| Currently lives with partner (at enrollment) | 38.5 | 26.4 | 39.6 | 36.0 | 38.9 |
| | | (<0.001) | | (0.339) | |
| | [10,232] | [9,340] | | [5,560] | |
| Currently lives with partner (at infant 12 months) | 50.3 | 38.6 | 51.4 | 36.6 | 52.3 |
| | | (<0.001) | | (<0.001) | |
| | [6,014] | [5,390] | | [5,685] | |

**Table 3** Adjusted odds ratios of the relationship of IPV to covariates

| Dependent variable | IPV in last 12 months | | IPV at 36 weeks pregnancy | | IPV 12 mo. post-delivery | |
|---|---|---|---|---|---|---|
| Covariate | OR | *p*-value | OR | *p*-value | OR | *p*-value |
| (Intercept) | 0.009 | <0.001 | 0.008 | <0.001 | 0.071 | 0.008 |
| Age | 1.016 | 0.210 | 1.001 | 0.974 | 0.966 | 0.053 |
| White non-Hispanic | 1.308 | 0.065 | 0.855 | 0.569 | 0.923 | 0.655 |
| Black/African American | 1.323 | 0.211 | 1.084 | 0.750 | 0.874 | 0.596 |
| Hispanic | 0.981 | 0.908 | 1.090 | 0.738 | 0.849 | 0.295 |
| Current partner | 0.690 | <0.001 | 1.238 | 0.247 | 1.568 | 0.021 |
| Ever married | 1.085 | 0.676 | 0.368 | 0.007 | 0.843 | 0.296 |
| Live with partner | 0.622 | <0.001 | 1.250 | 0.161 | 0.917 | 0.331 |
| High school graduate | 1.216 | 0.032 | 0.838 | 0.395 | 0.686 | 0.027 |
| Medicaid insurance | 1.142 | 0.136 | 1.268 | 0.143 | 0.977 | 0.816 |
| Drug use in last 14 days | 2.454 | 0.013 | 2.135 | 0.023 | 0.954 | 0.834 |
| Cigarettes during pregnancy | 2.084 | <0.001 | 1.687 | 0.002 | 1.728 | 0.001 |
| Positive affect | 1.151 | <0.001 | 1.167 | <0.001 | 1.107 | <0.001 |
| Personal belief | 0.990 | 0.481 | 0.939 | 0.053 | 0.992 | 0.698 |

## Multiple Logistic and Longitudinal Regression Models

Multiple logistic regression models confirmed several of the bivariate relationships observed (Table 3). Having a partner at the time of NFP enrollment is associated with 0.62 the odds of experiencing IPV before enrollment, but is associated with 1.6 times the odds of experiencing IPV in the 12 months after delivery. The same pattern was also significant for living with a partner at the time of enrollment, but this significance diminished for IPV experienced later in pregnancy and after delivery. Both drug and cigarette use at enrollment showed a significant positive association with the odds of experiencing IPV at all time points, with the exception of an association between drug use and IPV 12 months after delivery. A decline in positive affect was also associated with an increase in the odds for IPV at all time points ($p < 0.001$). Because the correlation between positive affect and personal belief is large (approximately $-0.35$), when both measures are included in the model, personal belief appears to not be related to IPV. However, in models that only include personal belief, it is also strongly associated with the odds of IPV experiences in this study population.

The longitudinal regression modeling indicated that the association of each variable with IPV in the 12 months prior to enrollment and the 12 months after delivery is relatively constant across time. Controlling for baseline demographics (Table 4), the odds of post-delivery IPV is

**Table 4** Longitudinal relationship of IPV to covariates

| Covariate | Odds ratio | *p*-value |
|---|---|---|
| (Intercept) | 0.010 | <0.001 |
| Post-delivery | 1.783 | 0.141 |
| Age | 0.981 | 0.330 |
| White non-Hispanic | 1.081 | 0.649 |
| Black/African American | 1.097 | 0.609 |
| Hispanic | 0.886 | 0.547 |
| Partner at enrollment | 1.082 | 0.553 |
| Ever married | 0.879 | 0.535 |
| Live with partner | 0.821 | 0.186 |
| High school graduate | 0.843 | 0.116 |
| Medicaid insurance | 1.080 | 0.450 |
| Drug use in last 14 days | 1.790 | 0.142 |
| Cigarettes during pregnancy | 2.260 | <0.001 |
| Positive affect | 1.142 | <0.001 |
| Personal belief | 0.986 | 0.255 |

estimated to be 1.8 times the odds of pre-enrollment IPV, but this increase is not statistically significant at the 0.05 level ($p = 0.139$).

Finally, logistic regression analyses of repeat pregnancies (Table 5) showed that younger women, black women, and women who reported current partners 12 months after delivery were more likely to report a repeat pregnancy within 24 months. However, perhaps the most striking effect is the risk of IPV after delivery. Controlling for other relevant variables, among women who reported experiencing IPV in the 12 months after delivery the odds of a repeat pregnancy within 24 months were estimated to be 3.7 times the odds for similar women who had not experienced IPV after delivery.

## Discussion

Three of the present investigation's major findings warrant closer attention. First, the rate of IPV during pregnancy (4.7%) was lower relative to the other time periods. This rate places NFP home visited women in the United States in the middle range of frequency of IPV relative to pregnant women from nineteen other countries [40]; however, the IPV measure used in this study (two items from the AAS) is restricted to moderate to severe physical IPV. Other studies have similarly found that IPV rates are lower during pregnancy [41, 42]. Romantic partners may be less likely to physically hurt their partner during pregnancy due to fears of hurting their unborn child or due to the extreme social unacceptability of assaulting a partner during that vulnerable time period. Alternatively, women may be as equally likely to experience IPV during pregnancy as post-pregnancy but may not disclose until well after the infant is born. Repeated administration of questions for IPV often increase identification rates over time [43] and women may not disclose IPV until they have had a long-term trusting relationship with their nurse home visitor. The finding that pre-enrollment IPV, which was assessed during the first

**Table 5** Adjusted odds ratios for the association between subsequent pregnancy and IPV

| Dependent variable | Pregnancy within 12 months of initial pregnancy | | Pregnancy within 18 months of initial pregnancy | | Pregnancy within 24 months of initial pregnancy | |
|---|---|---|---|---|---|---|
| Covariate | OR | *p*-value | OR | *p*-value | OR | *p*-value |
| (Intercept) | 0.460 | 0.124 | 0.718 | 0.448 | 0.702 | 0.436 |
| Age | 0.961 | 0.014 | 0.968 | 0.027 | 0.963 | 0.034 |
| White | 1.120 | 0.344 | 0.950 | 0.760 | 0.858 | 0.197 |
| Black | 1.731 | 0.001 | 1.503 | 0.003 | 1.394 | 0.012 |
| Hispanic | 1.150 | 0.250 | 1.074 | 0.583 | 1.011 | 0.931 |
| Medicaid at enrollment | 1.192 | 0.021 | 1.136 | 0.069 | 1.076 | 0.304 |
| Substance abuse at enrollment | 1.114 | 0.735 | 1.455 | 0.320 | 1.110 | 0.743 |
| Cigarette use at enrollment | 1.046 | 0.718 | 1.129 | 0.176 | 1.204 | 0.038 |
| Positive affect | 1.014 | 0.466 | 1.006 | 0.728 | 1.011 | 0.540 |
| Personal belief | 0.980 | 0.060 | 0.984 | 0.187 | 1.003 | 0.788 |
| Currently has a partner (at infant 12 months) | 1.003 | 0.984 | 1.153 | 0.440 | 1.222 | 0.256 |
| Currently lives with a partner (at infant 12 months) | 1.753 | 0.011 | 1.637 | 0.011 | 1.485 | 0.019 |
| IPV in last 12 months | 0.920 | 0.677 | 1.123 | 0.654 | 1.078 | 0.754 |
| IPV at 36 weeks pregnancy | 0.773 | 0.490 | 0.831 | 0.573 | 0.570 | 0.244 |
| IPV 12 mo. post-delivery | 4.732 | 0.008 | 4.535 | 0.001 | 3.707 | 0.005 |

few home visits, was more common than pregnancy IPV, which was typically assessed a few months later, argues against this alternative explanation. Women appear willing to disclose IPV early in their working relationship with their nurse home visitor. Regardless of whether pregnancy is a period of reduced risk for IPV, our rate is still alarmingly high and deserves clinical attention. As Devries and colleagues emphasize, "Intimate partner violence during pregnancy is more common than some maternal health conditions routinely screened for in antenatal care" [40, p. 158].

Second, IPV was not related to negative perinatal outcomes, including prematurity, low birth weight, and admission to the NICU. This finding is in sharp contrast to multiple recent comprehensive reviews that have noted a heightened risk of low birth weight or preterm births for women experiencing IPV [44, 45]. In the present study, we used a sample of women receiving a leading model of home visitation (NFP). This home visiting model provides a substantial visit schedule from pregnancy to the child's second birth, and addresses many other important maternal and child health domains, in addition to IPV. We speculate that there may be differences in sample population demographics, and risk factors as well as the fact that the primary intervention may explain the discrepant results. Perhaps the social support, referral assistance, and stress reduction techniques NFP nurses offer can help women overcome a significant portion of the deleterious effects of IPV on perinatal health.

Third, we found that reporting IPV at 12 months postdelivery was associated with lower rates of contraceptive use and higher rates of rapid repeat pregnancy at 12, 18, and 24 months. This finding held even after controlling for several confounding variables, such as partner status. Many recent studies have similarly documented that IPV is associated with a reduced likelihood of using a preferred method of birth control and a higher likelihood of unintended pregnancy [46, 47]. Our finding supports the notion that partners who perpetuate physical IPV against women may also engage in another form of abuse recently described in the literature as "reproductive coercion," "pregnancy coercion," or "birth control sabotage" [48–50]. These perpetrators may limit access to any form of birth control or may prevent women from using the most effective forms of birth in an attempt to get the woman pregnant again. In a pilot study, Miller et al. recently demonstrated that trained family planning counselors can substantially reduce the chances for future reproductive coercion [51].

The training that NFP RNs receive, and the curriculum used for her clients, emphasize family planning and include this specific content in the home visits during the pregnancy, infancy and toddler phases of the program. While this is an important intervention to address, we also found that access to reproductive health care is quite variable in communities, especially in the post-partum period following a pregnancy when many states limit continued eligibility for health care insurance and may be a significant barrier to successfully reducing reproductive coercion and subsequent rapid, repeat pregnancy.

The present study is among the largest longitudinal IPV investigations ever conducted. The study featured a racially and ethnically diverse sample of predominantly low-income young women, assessed IPV across different phases of life, and examined several perinatal and postnatal outcomes.

In addition to these considerable strengths, the following limitations should be highlighted. To begin with, physical IPV was the only form of violence under study in the present investigation. Given the high frequency of psychological violence during pregnancy and its negative impact on postnatal maternal mental health [52], non-physical forms of IPV may have impacted neonatal outcomes and rapid repeat pregnancy rates.

Furthermore, the fact that we found several statistically significant findings may reflect extremely large sample sizes as opposed to clinically meaningful results. However, an examination of the sizes of group differences and odds ratios suggests that many of these findings are clinically important, particularly regarding the relationship of IPV to rapid repeat pregnancy.

Finally, as is typical for a longitudinal study with samples collected across numerous community sites, we had a substantial amount of missing data. We addressed this limitation by using a leading approach to handling missing data—multiple imputation. The multiple imputation procedure assumed the missing data patterns only depended on the observed covariates (including the participation, as measured by the form completion rate). Since the majority of the missing data were from completely missing forms (>90% for all IPV variables), rather than selectively unanswered questions, we felt this assumption was reasonable. However, if those who were experiencing IPV were less likely to answer the IPV questions beyond the effect of program participation, our estimates may have been biased and interpretation of our results should be in the context of this potential bias.

Based on our findings, we recommend future IPV research include an emphasis on the following three areas. First, non-physical forms of IPV and their impact on perinatal and postnatal outcomes deserver closer attention. Second, other maternal prevention researchers should see if they can replicate our null finding regarding IPV and neonatal outcomes and should seek a better understanding of possible mechanisms of action. Third, interventions

should be developed to help women experiencing IPV obtain their desired forms of birth control to prevent reproductive coercion.

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