Associations of intimate partner violence with postnatal health practices in Bihar, India.
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Abstract

Background: Reducing neonatal mortality is a global priority, and improvements in postnatal health (PNH) practices in India are needed to do so. Intimate partner violence (IPV) may be associated with PNH practices, but little research has assessed this relationship.

Methods: A cross-sectional analysis of data from a representative household sample of mothers of neonates 0–11 months old in Bihar, India was conducted. The relationship between lifetime IPV experience (physical violence only, sexual violence only, or both physical and sexual violence) and PNH practices [clean cord care, kangaroo mother care, early initiation of breastfeeding (EIBF), delayed bathing, receipt of a postnatal care visit, exclusive breastfeeding, and current post-partum contraceptive use] was assessed using multivariate logistic regression.

Results: Over 45% of the 10,469 mothers experienced IPV in their lifetime. The three types of IPV experiences differentially related to PNH practices. Adjusted analyses revealed that compared to those who had never experienced IPV, women who experienced physical violence only (29.0%) had higher odds of skin-to-skin care (AOR = 1.67, 95% CI = 1.42, 1.96) and delayed bathing (AOR = 1.19, 95% CI = 1.03, 1.37), but lower odds of EIBF (AOR = 0.81, 95% CI = 0.70, 0.93) and exclusive breastfeeding (AOR = 0.83, 95% CI = 0.71, 0.96). Mothers who had experienced sexual violence only (2.3%) had lower odds of practicing EIBF (AOR = 0.52, 95% CI = 0.36, 0.76). Those who had both experiences of physical and sexual violence (14.0%) had increased odds of postpartum modern contraceptive use (AOR = 1.35, 95% CI = 1.07, 1.71) and lower odds of delayed bathing (AOR = 0.76, 95% CI = 0.63, 0.91).

Conclusions: The results of this study found differing patterns of vulnerability to poor PNH practices depending on the type of IPV experienced. Efforts to increase access to health services for women experiencing IPV and to integrate IPV intervention into such service may increase PNH practices, and as a result, reduce neonatal mortality.

Keywords: Intimate partner violence, Post-natal health, Breastfeeding, Post-partum contraception

Background
The United Nation’s Sustainable Development Goals highlight neonatal mortality as a priority, setting a target of 12 deaths per 1000 births by 2030, a goal that will require substantial acceleration of progress for many countries [1]. Practices known to promote neonatal health are key to reaching this target, as evidence suggests that postnatal care within 2 days of birth, clean cord care and early initiation of breastfeeding could eliminate 30–60%, 37%, and 16%–44% of neonatal deaths, respectively [2–7]. The World Health Organization recommends that women should receive postnatal care that teaches new mothers these healthy post-natal health (PNH) practices within the first 24 hours, followed by check-ups on the second or third day, and then on the seventh day after giving birth [8, 9]. In India, one of the most populous countries in the world, and where the neonatal mortality...
rate is 28 per 1000 live births, national programs to strengthen maternal and neonatal health services have likely contributed to reducing the neonatal mortality rate by half over the last 15 years, yet low rates of healthy PNH practices persist, likely inhibiting further improvement [10–13]. Strengthening PNH practices in India is essential to reducing neonatal mortality.

In Bihar, one of the poorest and most populous Indian states, the neonatal mortality rate is relatively high (32.2 per 1000 live births), with neonatal mortality strongly associated with inadequate PNH practices [13]. A number of social factors are associated with PNH practices, including wealth, maternal and paternal education, caste, and religion, indicating varying PNH practices across populations [14–16]. Intimate partner violence (IPV), a human rights violation faced by more than one in three married women in India and two in five married women in Bihar, has been documented to play an important role in maternal and infant health in India and other national contexts, and may have important implications for PNH practices [11, 17–20].

Global evidence documents that women who experience IPV are less likely to engage in maternal and child health protective behaviors, including health care seeking, prior to and after pregnancy [21–23]. Studies indicate that IPV compromises women’s health practices indirectly, by inducing stress/anxiety and depression, which can impede their ability to alter their circumstances and uptake social and health services, but also directly, as abusive male partners may actively prevent women’s protective health behaviors [21, 24–26]. Less research on this topic has focused on the postnatal period specifically, despite this being a similarly critical period for maternal and child health. The limited research on IPV and the postnatal period has focused on breastfeeding practices and consistently demonstrates that IPV is associated with lower likelihood of exclusively breastfeeding infants in the first 6 months of life [27–31]. Research from India also indicates physical and sexual IPV history is associated with not using contraception postpartum [23]. Despite this evidence linking IPV and a subset of PNH practices, we found no published research from India or globally that was specific to key PNH practices beyond breastfeeding and contraceptive use, such as clean cord care, kangaroo mother care (skin-to-skin care), and delayed bathing of newborns [28, 30–32]. Nor could we identify research on the association between IPV and post-partum clinical care, although extensive research from India and elsewhere indicates that IPV is associated with delayed or no antenatal care utilization [33–35]. The current study attempts to address this significant gap in research regarding associations between IPV and post-partum health practices which may reduce neonatal mortality.

Important in the assessment of IPV as a risk factor for poor PNH practices is consideration of physical and sexual violence separately, as well as their co-occurrence, as a growing body of research suggests different forms of IPV relate to unique patterns of health practices [18, 25, 33, 34]. Previous research in India has identified that women experiencing only physical IPV are less likely than those reporting no IPV to utilize sexual health services [23, 36]. Indian women experiencing only sexual IPV have been found to be more likely to use modern contraceptives compared to women reporting no IPV [23, 34]. In the same study, however, no association was found between experiencing physical IPV alone and modern contraceptive use [23, 34].

The current study aims to elucidate the relationship between IPV, specifically when a woman has experienced physical violence only, sexual violence only, or both forms of violence, and PNH practices among a representative sample of mothers of living infants in Bihar, India. Understanding these relationships may help guide the development of new and ongoing interventions to promote neonatal survival.

**Methods**

The current study includes analysis of data collected for evaluation of the Ananya program, a partnership initiated in 2012 in Bihar, India, by the Government of Bihar and the Bill and Melinda Gates Foundation designed to increase maternal and child health care utilization in the public health system using a combination of supply-side and demand generation efforts [37]. Ananya was implemented using a two-armed quasi-experimental design in which eight intervention districts were compared to the remaining 30 standard care districts. Baseline data, collected in 2012, did not include any measures of IPV, therefore the current analysis is limited to cross-sectional data from the second statewide household survey collected January to April 2014 from a representative sample of mothers of 0–11 month old infants. All data were collected by trained female study staff, subsequent to acquisition of written informed consent.

A multi-stage sampling approach was used to select villages, randomly selecting first blocks, then villages from those blocks. A listing exercise was conducted in each selected village to identify all women who had a live birth in the previous 12 months (about 13 women per village, on average). Details on study sampling and procedures are available in a previous publication by Borkum et al. [38].

The survey participation rate was 87% and yielded 11,654 completed surveys from mothers of living children 0–11 months old [38]. Women who had ever been married with a living, singleton child aged 0–11 months and were not pregnant at the time of interview were
included in this analysis \( (n = 10,469) \); mothers of neonates requiring postnatal medical care were not excluded. Ethical approval for the original evaluation study was provided by India’s Health Ministry Screening Committee. Ethical approval for this analysis was provided by the University of California, San Diego.

Measures
The primary independent variables were lifetime experiences of physical and sexual IPV considered as exclusive categories: no IPV, physical IPV only, sexual IPV only, sexual and physical IPV. Physical IPV was defined as experience of at least one of the following by a husband: being slapped, having an arm twisted or hair pulled, being pushed with his fist, being shaken or having something thrown at you, being kicked, dragged or beaten up, or attempted intentional choking or burning. Sexual IPV was measured by a yes/no response to, “Did your husband ever physically force you to have sexual intercourse with him even when you did not want to?” These measures have been validated in the Multi-country Study on Violence Against Women by the World Health Organization and are routinely included in Demographic and Health Surveys (DHS) [21].

Outcome variables included the following healthy newborn practices: clean cord care (nothing applied to umbilicus after cutting/tying cord); kangaroo mother care (child placed unclothed with skin to skin contact on mother’s chest/abdomen following birth); early initiation of breastfeeding (EIBF; newborn was breastfed within 1 h of birth); delayed bathing (first bath occurred 2 or more days after birth); postnatal care visit by a health worker within 48 h of birth; and exclusive breastfeeding (child received only breastmilk in 24 h prior to the survey for children <6 months; 6 months of exclusive breastfeeding reported for children 6–11 months). Current post-partum contraceptive use was defined as female or male sterilization, or current use of pill, injectable, intrauterine device (IUD), or condom. If contraceptive use was initiated post-partum but discontinued prior to the study, it was not considered current post-partum contraceptive use.

Relevant background characteristics were included as covariates: residence in an Ananya program district (yes/no); age of mother (15–19, 20–24, 25–29, 30+); age of mother at marriage (under 18 years/over 18 years old); household wealth index (quartiles; a variable constructed via principle component analysis of household characteristics and assets following the technique used in DHS); [39] mother’s education (none, primary [1–8 years], secondary [9+ years]); husband’s education (none, primary [1–8 years], secondary [9+ years]); religion/caste status (belonging to either of the minority, most-marginalized social groups in India; Muslim, scheduled caste/scheduled tribe [SC/ST], or neither); gender of focal child (male/female); parity of mother (1 birth, 2 births, 3 + births); prior neonatal death or stillbirth (one or more children stillborn or died as neonate prior to focal child/none); antenatal care visits (ANC; <4 ANC visits, 4+ ANC visits); skilled birth attendant (SBA) at birth of focal child (yes/no); age of focal child (in months); and visits of community health worker (CHW) in late pregnancy (<2/2+ CHW visits in last trimester). For analyses related to current post-partum contraceptive use, the covariate of postnatal CHW visits in which family planning was discussed (yes/no) was also included.

Data analysis
Descriptive frequencies were calculated for all PNH practice outcomes and covariates, both overall and stratified by IPV experiences. Multivariate logistic regression models were then used to assess the association between IPV and each PNH practice, adjusting for any covariates that were significant at \( p < 0.20 \) levels in bivariate analyses (results not shown). All analyses were adjusted for survey design and individual sampling weights, and were conducted using Stata 13 SE (Stata Corp, College Station, TX).

Results
More than 40% of the 10,469 mothers reported ever experiencing physical IPV by their husband (29.0% only physical violence, 14.0% physical violence accompanied by sexual violence) and more than one in six mothers reported ever experiencing sexual violence from their husband (2.3% sexual violence only, 14.0% sexual violence accompanied by physical violence) (Table 1). Almost all women (98%) who experienced IPV in their lifetimes reported recent experiences of IPV, with similar prevalence between recent and lifetime experiences (IPV in the last 12 months: physical only = 28.3%, sexual only = 2.8%, physical and sexual = 12.3%).

The majority of participants (78.2%) were between the ages of 20–29 and more than two-thirds had at least two children (Table 1). Nearly half of women (45.1%) were under age 18 when they married, 53.1% received no education, and 43.2% belonged to a marginalized religion/caste. Healthy newborn practices of delayed bathing (57.4%), early initiation of breastfeeding (48.2%) and exclusive breastfeeding (67.0%) were practiced by a moder-ate proportion of the sample, while clean cord care (25.0%), skin-to-skin care (34.6%), receiving postnatal care within 48 h (14.1%), and current post-partum contraceptive use (14.7%) were less common.

Experiencing physical IPV only was disproportionately prevalent among mothers who practiced skin-to-skin care (42.1% vs. 32.2% no IPV), were age 30+ (21.5% vs. 15% no IPV), were under age 18 when they married
| Total Lifetime experience of intimate partner violence | Physical and Sexual IPV |
|---|---|---|---|---|
| | No IPV | Physical IPV only | Sexual IPV only | Unwtd. N % (95% CI) |
| Total | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) |
| 10,469 | 5743 | 54.8% (53.0–56.5) | 3019 | 29.0% (27.5–30.6) | 241 | 2.3% (1.8–2.8) | 1466 | 14.0% (12.8–15.3) |
| Outcomes | | | | |
| Clean cord care | | | | |
| No | 7920 | 75.0% (73.4–76.6) | 4316 | 74.1% (72.0–76.1) | 2303 | 75.1% (72.3–77.7) | 186 | 77.8% (68.7–84.8) | 1115 | 78.0% (74.5–81.1) |
| Yes | 2549 | 25.0% (23.4–26.6) | 1427 | 25.9% (23.9–28.0) | 716 | 24.9% (22.3–27.7) | 55 | 22.2% (15.2–31.3) | 351 | 22.0% (18.9–25.5) |
| Skin-to-skin care | | | | |
| No | 6935 | 65.4% (63.0–67.7) | 3944 | 67.8% (64.9–70.5) | 1781 | 57.9% (54.3–61.3) | 154 | 63.0% (52.9–72.1) | 1056 | 71.8% (67.1–76.2) |
| Yes | 3534 | 34.6% (32.3–37.0) | 1799 | 32.2% (29.5–35.1) | 1238 | 42.1% (38.7–46.7) | 87 | 37.0% (27.9–47.1) | 410 | 28.2% (23.8–32.9) |
| Early initiation of breastfeeding | | | | |
| No | 5443 | 51.8% (50.0–53.7) | 2900 | 49.3% (47.1–51.5) | 1629 | 54.5% (51.5–57.5) | 139 | 65.4% (56.8–73.1) | 775 | 54.0% (49.4–58.6) |
| Yes | 5026 | 48.2% (46.3–50.0) | 2843 | 50.7% (48.5–52.9) | 1390 | 45.5% (42.5–48.5) | 102 | 34.6% (26.9–43.2) | 691 | 46.0% (41.4–50.6) |
| Delay of first bath | | | | |
| No | 4394 | 42.6% (40.7–44.6) | 2414 | 41.7% (39.4–44.1) | 1198 | 40.2% (37.4–43.1) | 105 | 47.7% (38.5–57.1) | 677 | 50.5% (46.1–54.9) |
| Yes | 6075 | 57.4% (55.4–59.3) | 3329 | 58.3% (55.9–60.6) | 1821 | 59.8% (56.9–62.6) | 136 | 52.3% (42.9–61.5) | 495 | 49.5% (45.1–53.9) |
| Postnatal care within 48 h | | | | |
| No | 9105 | 85.9% (84.5–87.1) | 5038 | 86.8% (85.3–88.2) | 2607 | 84.8% (82.3–86.9) | 200 | 82.7% (71.8–90.0) | 1260 | 84.9% (81.2–88.1) |
| Yes | 1364 | 14.1% (12.9–15.5) | 705 | 13.2% (11.8–14.7) | 412 | 15.2% (13.1–17.7) | 41 | 17.3% (10.0–28.2) | 206 | 15.1% (11.9–18.8) |
| Exclusive breastfeeding | | | | |
| No | 3400 | 33.0% (31.6–34.4) | 1832 | 31.3% (29.3–33.3) | 1011 | 35.5% (33.1–37.9) | 87 | 37.6% (28.4–47.7) | 470 | 33.8% (30.2–37.6) |
| Yes | 7069 | 67.0% (65.6–68.4) | 3911 | 68.7% (66.7–70.7) | 2008 | 64.5% (62.1–66.9) | 154 | 62.4% (52.3–71.6) | 996 | 66.2% (62.4–69.8) |
Table 1: Frequencies of maternal and neonatal care outcomes and background characteristics, overall and stratified by experiences of physical and sexual intimate partner violence (N = 10,469) (Continued)

|                          | Total Lifetime experience of intimate partner violence |
|--------------------------|-------------------------------------------------------|
|                          | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) |
|                          |          |            | No IPV   |            | Physical IPV only |            | Sexual IPV only |            | Physical and Sexual IPV |            |
|                          |          |            | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) |
| Post-partum contraception |          |            |          |            |          |            |          |            |          |            |
| No                       | 8835     | 85.3% (84.0–86.5) | 4894     | 85.9% (84.2–87.4) | 2562     | 86.8% (85.0–88.4) | 202       | 86.7% (80.7–91.1) | 1177     | 79.4% (75.8–82.7) |
| Yes                      | 1634     | 14.7% (13.5–16.0)  | 849      | 14.1% (12.6–15.8)  | 457      | 13.2% (11.6–15.0)  | 39        | 13.3% (8.9–19.3)  | 289      | 20.6% (17.3–24.2)  |
| Background characteristics|          |            |          |            |          |            |          |            |          |            |
| Ananya district           |          |            |          |            |          |            |          |            |          |            |
| No                       | 7833     | 76.9% (74.0–79.7)  | 4250     | 75.6% (72.2–78.7)  | 2281     | 78.0% (74.3–81.2)  | 194       | 84.5% (76.8–90.0) | 1108     | 78.8% (74.3–82.7)  |
| Yes                      | 2636     | 23.1% (20.3–26.0)  | 1493     | 24.4% (21.3–27.8)  | 738      | 22.0% (18.8–25.7)  | 47        | 15.5% (10.0–23.2) | 358      | 21.2% (17.3–25.7)  |
| Age                      |          |            |          |            |          |            |          |            |          |            |
| 15–19                    | 391      | 4.1% (3.5–4.9)    | 233      | 4.5% (3.6–5.6)     | 98       | 3.8% (2.8–5.3)     | 11        | 2.9% (1.1–7.7)    | 49       | 3.5% (2.5–5.0)     |
| 20–24                    | 4413     | 42.3% (40.7–44.0)  | 2552     | 44.2% (42.1–46.3)  | 1176     | 39.3% (36.5–42.2)  | 99        | 45.0% (35.4–54.9) | 586      | 40.9% (37.1–44.8)  |
| 25–29                    | 3905     | 35.9% (34.2–37.5)  | 2120     | 36.3% (34.1–38.5)  | 1137     | 35.3% (32.7–38.0)  | 99        | 41.5% (32.6–51.0) | 549      | 34.4% (30.8–38.1)  |
| 30+                      | 1760     | 17.7% (16.4–19.0)  | 838      | 15.0% (13.5–16.7)  | 608      | 21.5% (193–23.9)   | 32        | 10.6% (6.5–17.0)  | 282      | 21.2% (18.0–24.7)  |
| Age at marriage           |          |            |          |            |          |            |          |            |          |            |
| < 18                     | 4594     | 45.1% (43.1–47.1)  | 2162     | 39.4% (37.2–41.7)  | 1587     | 52.6% (495–55.7)   | 118       | 52.1% (41.7–62.2) | 727      | 50.5% (46.2–54.8)  |
| 18+                      | 5875     | 54.9% (52.9–56.9)  | 3581     | 60.6% (58.3–62.8)  | 1432     | 47.4% (443–50.5)   | 123       | 47.9% (378–58.3)  | 739      | 49.5% (45.2–53.8)  |
| Wealth quartile          |          |            |          |            |          |            |          |            |          |            |
| 1 (poorest)              | 2877     | 28.6% (26.5–30.8)  | 1402     | 25.8% (23.5–28.1)  | 989      | 34.4% (309–37.9)   | 62        | 21.8% (15.6–29.7) | 424      | 29.0% (24.8–33.9)  |
| 2                        | 2140     | 21.3% (19.9–22.8)  | 1129     | 21.7% (20.0–23.6)  | 670      | 21.8% (195–24.3)   | 38        | 18.0% (120–26.1)  | 303      | 19.2% (16.3–22.6)  |
| 3                        | 2509     | 24.7% (23.3–26.2)  | 1293     | 23.3% (21.5–25.2)  | 733      | 24.2% (218–26.7)   | 72        | 38.0% (281–49.0)  | 411      | 29.2% (25.5–33.2)  |
| 4 (wealthiest)           | 2943     | 25.4% (23.5–27.3)  | 1919     | 29.3% (26.9–31.8)  | 627      | 19.7% (172–22.4)   | 69        | 22.1% (147–31.9)  | 328      | 22.6% (18.8–26.9)  |
### Table 1: Frequencies of maternal and neonatal care outcomes and background characteristics, overall and stratified by experiences of physical and sexual intimate partner violence (N = 10,469) (Continued)

| Education                     | Total Lifetime experience of intimate partner violence | Physical IPV only | Sexual IPV only | Physical and Sexual IPV |
|-------------------------------|------------------------------------------------------|-------------------|----------------|-------------------------|
|                               | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) |
|                               |          |            |          |            |          |            |          |            |
| None                          | 5351     | 53.1% (50.9–55.2) | 2569     | 47.6% (45.1–50.1) | 1817     | 62.0% (59.1–64.9) | 112     | 45.8% (36.4–55.5) | 853     | 56.9% (52.4–61.3) |
| Primary                       | 2705     | 25.9% (24.4–27.4) | 1520     | 26.6% (25.0–28.7) | 740      | 23.3% (21.0–25.8) | 68      | 30.2% (23.4–38.0) | 377     | 26.7% (22.8–31.0) |
| Secondary                     | 2413     | 21.1% (19.6–22.7) | 1654     | 25.5% (23.5–27.7) | 462      | 14.7% (12.7–16.9) | 61      | 24.0% (17.7–31.8) | 236     | 16.4% (13.3–20.0) |
| Spouse's education            |          |            |          |            |          |            |          |            |          |            |
| None                          | 3237     | 32.4% (30.5–34.4) | 1518     | 28.5% (26.4–30.8) | 1132     | 39.5% (36.6–42.5) | 69      | 23.3% (16.8–31.5) | 518     | 34.4% (30.8–38.2) |
| Primary                       | 3504     | 33.9% (32.5–35.3) | 1877     | 33.0% (31.2–34.9) | 1045     | 35.6% (33.3–38.1) | 74      | 33.3% (24.5–43.4) | 508     | 33.9% (30.6–37.4) |
| Secondary                     | 3728     | 33.7% (31.7–35.7) | 2348     | 38.5% (36.0–41.0) | 842      | 24.9% (22.1–27.8) | 98      | 43.4% (33.3–54.0) | 440     | 31.7% (27.7–35.9) |
| Caste/religion                |          |            |          |            |          |            |          |            |          |            |
| Neither SC/ST nor Muslim      | 5963     | 56.8% (53.7–59.8) | 3507     | 61.1% (57.5–64.6) | 1558     | 51.4% (47.8–55.1) | 149     | 63.3% (52.8–72.7) | 749     | 49.8% (44.3–55.3) |
| SC/ST                         | 2693     | 26.0% (23.5–28.6) | 1178     | 21.0% (18.5–23.8) | 991      | 33.2% (29.7–36.9) | 53      | 19.0% (12.6–27.7) | 471     | 31.4% (26.7–36.5) |
| Muslim                        | 1813     | 17.2% (14.6–20.3) | 1058     | 17.8% (14.8–21.3) | 470      | 15.4% (12.5–18.8) | 39      | 17.7% (11.4–26.5) | 246     | 18.8% (14.5–24.1) |
| Gender of focal child         |          |            |          |            |          |            |          |            |          |            |
| Female                        | 4857     | 46.4% (45.0–47.9) | 2663     | 46.3% (44.5–48.2) | 1439     | 47.6% (44.8–50.4) | 109     | 39.8% (31.4–48.8) | 646     | 45.4% (41.6–49.3) |
| Male                          | 5612     | 53.6% (52.1–55.0) | 3080     | 53.7% (51.8–55.5) | 1580     | 52.4% (49.6–55.2) | 132     | 60.2% (51.2–68.6) | 820     | 54.6% (50.7–58.4) |
| Parity                        |          |            |          |            |          |            |          |            |          |            |
| 1                             | 3239     | 30.9% (29.5–32.4) | 2036     | 35.0% (33.2–36.8) | 778      | 27.0% (24.6–29.5) | 69      | 29.5% (20.5–40.5) | 356     | 23.4% (20.5–26.7) |
| 2                             | 2979     | 27.7% (26.4–29.1) | 1663     | 28.2% (26.6–29.8) | 827      | 26.5% (24.1–29.2) | 72      | 32.2% (23.8–42.0) | 417     | 27.8% (24.2–31.6) |
| 3+                            | 4251     | 41.3% (39.8–42.9) | 2044     | 36.8% (35.0–38.7) | 1414     | 46.5% (43.7–49.3) | 100     | 38.3% (29.9–47.5) | 693     | 48.8% (45.1–52.5) |
| Age of child (months) a       | –        | 5.0 (4.9–5.1) | –        | 4.9 (4.8–5.1) | –        | 5.1 (5.0–5.3) | –        | 4.9 (4.3–5.6) | –        | 5.2 (5.0–5.4) |
Table 1 Frequencies of maternal and neonatal care outcomes and background characteristics, overall and stratified by experiences of physical and sexual intimate partner violence (N=10,469) (Continued)

| Total Lifetime experience of intimate partner violence | Total Lifetime experience of intimate partner violence |
|-------------------------------------------------------|-------------------------------------------------------|
| | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) | Unwtd. N | % (95% CI) |
| Previous neonatal death or stillbirth | | | | | | | | |
| No | 9588 | 91.3% (90.4–92.2) | 5336 | 93.0% (91.9–93.9) | 2741 | 89.8% (88.1–91.4) | 216 | 84.6% (76.1–90.5) | 1295 | 89.2% (86.4–91.5) |
| Yes | 881 | 8.7% (7.8–9.6) | 407 | 7.0% (6.1–8.1) | 278 | 10.2% (8.6–11.9) | 25 | 15.4% (9.5–23.9) | 171 | 10.8% (8.5–13.6) |
| 4 or more antenatal care visits | | | | | | | | |
| No | 8400 | 81.2% (79.7–82.5) | 4459 | 78.2% (76.2–80.1) | 2524 | 85.5% (83.7–87.2) | 192 | 80.4% (73.0–86.2) | 1225 | 83.7% (81.0–86.2) |
| Yes | 2069 | 18.8% (17.5–20.3) | 1284 | 21.8% (19.9–23.8) | 495 | 14.5% (12.8–16.3) | 49 | 19.6% (13.8–27.0) | 241 | 16.3% (13.8–19.0) |
| Skilled birth attendance | | | | | | | | |
| No | 2826 | 28.0% (26.1–30.0) | 1382 | 24.9% (22.8–27.1) | 958 | 32.6% (29.5–36.0) | 65 | 29.3% (21.9–38.1) | 421 | 30.4% (26.6–34.9) |
| Yes | 7643 | 72.0% (70.0–73.9) | 4361 | 75.1% (72.9–77.2) | 2061 | 67.4% (64.0–70.5) | 176 | 70.7% (61.9–78.1) | 1045 | 69.6% (65.5–73.4) |
| 2+ CHW visits in final trimester | | | | | | | | |
| No | 7148 | 67.1% (65.0–69.1) | 4060 | 69.3% (66.6–71.9) | 1969 | 64.4% (61.0–67.7) | 159 | 59.9% (50.3–68.8) | 960 | 65.0% (60.2–69.5) |
| Yes | 3321 | 32.9% (30.9–35.0) | 1683 | 30.7% (28.1–33.4) | 1050 | 35.6% (32.3–39.0) | 82 | 40.1% (31.2–49.7) | 506 | 35.0% (30.5–39.8) |
| Postnatal CHW visit discussing family planning | | | | | | | | |
| No | 9184 | 87.3% (85.9–88.6) | 5214 | 90.2% (88.6–91.7) | 2556 | 84.3% (81.6–86.6) | 206 | 85.5% (78.7–90.4) | 1208 | 82.4% (78.0–86.0) |
| Yes | 1285 | 12.7% (11.4–14.1) | 529 | 9.8% (8.3–11.4) | 463 | 15.7% (13.4–18.4) | 35 | 14.5% (9.6–21.3) | 258 | 17.6% (14.0–22.0) |

*Mean (95% confidence interval)
Post-hoc exploratory analysis identified that of the 1274 women using post-partum modern contraceptives, 119 (9.3%) were using male or female sterilization, 31 (2.4%) oral contraception (pills), 62 (4.9%) condoms, and 11 (0.9%) other methods for preventing pregnancy. A multinomial regression assessing the association between IPV and method-specific current contraceptive use found that, relative to women who had not experienced IPV, women experiencing physical IPV only were less likely to be using oral contraception (adjusted relative risk ratio [ARRR] = 0.53, 95% CI = 0.32, 0.87, \( p = 0.01 \)) and women experiencing both physical and sexual IPV were twice as likely to be using condoms (ARRR = 2.04, 95% CI = 1.43, 2.92, \( p < 0.001 \)) (Table 3). Different patterns of association of type of IPV with sterilization and with other forms of contraception were not observed.

Discussion

Findings from this study indicate that almost half of women in Bihar, India have experienced physical and/or sexual violence from their husband. One in six women reported sexual violence, most often accompanied by physical violence. Associations between IPV and PNH practices were found, including healthy breastfeeding practices, skin to skin care, delayed bathing, and post-partum contraception use, but suggest a complex risk pattern across types of IPV.

The National Family Health Survey-4 (NFHS-4) conducted in 2015/16 found a similar rate of spousal violence among ever-married women in Bihar (43.2%) [17]. Sexual violence was (16.3%) was also common, with only 2% of women experiencing sexual violence without physical violence. This prevalence reflects that reported for Bihar in the NFHS-3 conducted in 2005/6 (NFHS-4 data not yet available) [11].

Intimate partner violence was negatively associated with healthy breastfeeding practices. The odds of early initiation of breastfeeding were decreased by between 19% and 48% among women who experienced physical or sexual IPV, respectively. This pattern is consistent with earlier studies of the association of types of IPV and breastfeeding [28, 32, 40, 41].

Odds of exclusive breastfeeding for 6 months were 17% lower among women reporting physical IPV only. Uniform with earlier studies, these results could possibly indicate limited autonomy of mothers to make breastfeeding decisions, lower confidence to be able to breastfeed, or resistance to the intimate personal contact involved in breastfeeding related to trauma [27, 28, 31, 32, 40–44].

A novel finding from this study is that women who reported only physical violence were more likely to enact certain PNH practices, including skin-to-skin care and
Table 2 Multivariate logistic regression models showing relationship between intimate partner violence and postnatal care behaviors and services (n = 10,469)

| Lifetime experience of intimate partner violence | Clean cord care | Skin-to-skin care | Early initiation of breastfeeding | Delay of first bath | Postnatal care within 48 h | Exclusive breastfeeding | Post-partum contraception |
|--------------------------------------------------|-----------------|-------------------|----------------------------------|---------------------|---------------------------|------------------------|--------------------------|
| Never                                            | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| Physical only                                    | 0.92 (0.78–1.08) | 1.66 (1.41–1.96)*** | 0.81 (0.71–0.93)*** | 1.19 (1.03–1.37)* | 1.16 (0.95–1.42) | 0.83 (0.71–0.96)* | 0.82 (0.68–0.998)* |
| Sexual only                                       | 0.91 (0.58–1.41) | 1.33 (0.85–2.06)   | 0.52 (0.36–0.76)*** | 0.87 (0.60–1.26)  | 1.22 (0.65–2.29) | 0.74 (0.49–1.12) | 0.91 (0.56–1.46) |
| Physical and sexual                              | 0.82 (0.66–1.02) | 0.87 (0.68–1.12)   | 0.83 (0.67–1.01)       | 0.76 (0.63–0.91)** | 1.14 (0.85–1.55) | 0.92 (0.75–1.15) | 1.35 (1.07–1.71)* |
| Ananya district                                   | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| No                                               | 1.52 (1.24–1.85)*** | 1.53 (1.25–1.88)*** | 1.21 (1.04–1.41)* | 1.53 – | – | 1.16 (1.00–1.34)* | 1.48 (1.18–1.86)** |
| Yes                                              | 1.16 (1.00–1.34) | 0.98 (1.04–1.32)*** | 1.13 (1.04–1.34)** | – | 1.14 (0.99–1.32) | 1.06 (0.89–1.25) |
| Age                                              | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| 15–19                                            | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| 20–24                                            | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| 25–29                                            | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| 30+                                              | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| Age at marriage                                   | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| < 18                                             | 1.40 (1.20–1.63)*** | 1.15 (0.98–1.34) | 1.17 (1.04–1.32)** | 1.18 – | – | 1.14 (0.99–1.32) | 1.06 (0.89–1.25) |
| 18+                                              | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| Wealth quartile                                   | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| 1 (poorest)                                       | 0.96 (0.80–1.16) | 1.08 (0.88–1.34)   | –                                | 0.85 (0.72–1.01) | 1.13 (0.85–1.50) | 1.06 (0.87–1.29) | 1.12 (0.89–1.41) |
| 2                                                 | 0.80 (0.68–0.96)* | 1.27 (1.00–1.60)* | –                                | 0.88 (0.74–1.04) | 1.18 (0.91–1.54) | 0.92 (0.76–1.11) | 1.38 (1.11–1.72)** |
| 3                                                 | 0.92 (0.71–1.18) | 1.30 (1.04–1.62)* | –                                | 0.89 (0.73–1.08) | 0.90 (0.67–1.22) | 0.84 (0.69–1.03) | 1.43 (1.13–1.82)** |
| 4 (wealthiest)                                    | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| Education                                         | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| None                                              | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| Primary                                           | 0.95 (0.80–1.12) | 1.16 (1.02–1.34)* | 1.04 –                           | – | – | – | |
| Secondary                                         | 0.92 (0.73–1.15) | 0.85 (0.73–1.00)   | 0.98 –                           | – | – | – | |
| Spouse’s education                                 | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| None                                              | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| Primary                                           | 0.85 (0.71–1.03) | –                  | –                                | 0.94 – | – | 0.84 (0.72–0.98)* | – |
| Secondary                                         | 0.72 (0.59–0.89)** | –                  | –                                | 1.01 – | – | 0.92 (0.77–1.10) | – |
| Caste/religion                                     | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| Neither SC/ST nor Muslim                           | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |
| SC/ST                                             | REF             | REF               | REF                              | REF                 | REF                       | REF                    | REF                      |

Notes: Bold values indicate statistical significance at p < 0.05; ** indicates p < 0.01; *** indicates p < 0.001.
delayed bathing. A possible explanation for this relationship may be that, while experiencing physical IPV may force a woman to compromise her own health and self-care, she may work even harder than her peers to provide adequate care for her infant as a way of compensating for any disruptions her husband’s IPV may be causing within the family [45]. In contrast with these findings, women experiencing a combination of physical and sexual violence appear to be less able to enact these same PNH behaviors. Previous research in Brazil has documented higher risk of postpartum depression associated with the co-occurrence of multiple forms of violence during pregnancy [46]. This previous work may shed some light on why the present study observed lower rates of PNH behaviors among women experiencing multiple forms of violence. The opposing effects seen in this sample for these PNH practices for different types of IPV may have important implications for

| Clean cord care | Skin-to-skin care | Early initiation of breastfeeding | Delay of first bath | Postnatal care within 48 h | Exclusive breastfeeding | Post-partum contraception |
|----------------|-------------------|----------------------------------|---------------------|---------------------------|------------------------|--------------------------|
| Muslim         | 0.79 (0.62–1.00)  | 0.77 (0.63–0.95)*                | 1.09 (0.91–1.30)    | --                        | --                     | 0.59 (0.45–0.78)***      |
| Gender of focal child |            | C                                       | D                                    | E                                      | F                                      | G                                      |
| Female         | --                | --                                 | --                                 | --                                    | --                                    | REF                          |
| Male           | --                | --                                 | --                                 | --                                    | --                                    | 1.17 (0.99–1.39)           |
| Parity         |                   |                                   |                                    |                                        |                                        |                            |
| 1              | --                | REF                               | REF                                | REF                                   | REF                                   | REF                          |
| 2              | --                | 0.97 (0.83–1.13)                  | 1.29 (1.10–1.51)**               | 1.05 (0.90–1.23)                     | --                                    | 1.25 (1.06–1.47)**          | (1.37–2.25)***             |
| 3+             | --                | 0.91 (0.77–1.09)                  | 1.26 (1.05–1.52)*               | 1.08 (0.90–1.29)                     | --                                    | 1.18 (1.01–1.37)*           | (2.61–4.40)***             |
| Age of child (months) | 0.97 (0.95–0.99)* | --                                 | 0.98 (0.96–0.999)               | --                                    | 0.78 (0.77–0.80)               | 1.08 (1.06–1.11)***         |
| Previous neonatal death or stillbirth |                   | C                                   | D                                    | E                                      | F                                      | G                                      |
| No             | --                | REF                               | REF                                | REF                                   | REF                                   | REF                          |
| Yes            | --                | 0.88 (0.68–1.13)                  | 0.66 (0.54–0.82)                | 0.88 (0.71–1.08)                     | --                                    | --                          |
| 4 or more antenatal care visits |                   |                                   |                                    |                                        |                                        |                            |
| No             | REF               | --                                 | --                                 | --                                    | --                                    | --                          |
| Yes            | 0.82 (0.67–1.01)  | --                                 | 1.16 (0.99–1.35)                | 1.32 (1.05–1.66)*                    | 0.81 (0.68–0.97)*               | 1.23 (1.01–1.49)*           | (1.01–1.49)***             |
| Skilled birth attendance |                   |                                   |                                    |                                        |                                        |                            |
| No             | REF               | REF                               | REF                                | REF                                   | REF                                   | REF                          |
| Yes            | 0.81 (0.70–0.94)**| 1.54 (1.29–1.84)***               | 1.19 (1.03–1.37)*               | 1.92 (1.66–2.21)***                  | 1.82 (1.37–2.41)***             | 1.21 (1.04–1.39)*           | (1.12–1.70)***             |
| 2+ CHW visits in final trimester |                   |                                   |                                    |                                        |                                        |                            |
| No             | --                | REF                               | REF                                | --                                    | --                                    | --                          |
| Yes            | --                | 1.27 (1.07–1.51)**                | 1.26 (1.11–1.44)***             | --                                    | 4.22 (3.46–5.15)***             | 0.88 (0.72–1.06)            |
| Postnatal CHW visit discussing family planning |                   |                                   |                                    |                                        |                                        |                            |
| No             | N/A               | N/A                               | N/A                                | N/A                                   | N/A                                   | N/A                          |
| Yes            | N/A               | N/A                               | N/A                                | N/A                                   | N/A                                   | 2.34 (1.88–2.92)***         |

Models show adjusted odds ratios (95% confidence intervals), and include intimate partner violence as well as any covariates significant at the p < 0.20 level in bivariate models

*p < 0.05  
**p < 0.01  
***p < 0.001  

1Mean (95% confidence interval)
understanding how the context of IPV contributes to health practices and warrant further study. Further work in this area should consider assessment of motivations for and barriers to these practices in the context of IPV, particularly in the case of delayed bathing which is affected by both culture and access to soap and water, where skin-to-skin contact requires primarily bodily resources, such as time and energy, from the mother.

Likelihood of postpartum contraception also differed across IPV experiences. Women who reported experiencing only physical IPV had 18% lower odds of postpartum contraception, while women reporting both sexual and physical IPV had a 35% increased odds of postpartum contraception. Significantly lower postpartum oral contraception use among women experiencing physical IPV only and significantly higher postpartum condom use among women experiencing physical and sexual IPV was observed. These findings were unexpected in light of prior research conducted with representative samples in India. These method-specific results differed from prior findings from national data of married women in India that found lower condom but higher oral contraception use among women experiencing physical IPV. Raj et al. found that in a situation where skin-to-skin contact requires primarily bodily resources, such as time and energy, from the mother.

Table 3 Post-hoc multinomial regression model assessing relationship between intimate partner violence and type of current postpartum contraception use

| Lifetime experience of IPV | Sterilization (male or female) | Pill | Condom | Other^ |
|---------------------------|--------------------------------|------|--------|--------|
| No IPV ever               | REF                            | REF  | REF    | REF    |
| Physical IPV only         | 0.89 (0.70–1.13)               | 0.53 (0.32–0.87)* | 0.95 (0.67–1.33) | 0.60 (0.27–1.36) |
| Sexual IPV only           | 0.97 (0.49–1.92)               | 1.00 (0.37–2.67) | 0.94 (0.47–1.89) | 0.25 (0.05–1.23) |
| Physical and sexual IPV   | 1.13 (0.82–1.55)               | 1.17 (0.64–2.13) | 2.04 (1.43–2.92)** | 1.23 (0.52–2.90) |

Multinominal regression model shows adjusted relative risk ratios (95% confidence intervals), and adjusts for all covariates shown in the post-partum contraception model in Table 2. Reference category is no current contraception

^Includes IUD and injectables
*p < 0.05
***p < 0.001

Exposure to health services, including ANC, SBA, and CHW visits during the last trimester of pregnancy, emerged as experiences largely beneficial to enactment of PNH practices, even in models adjusted for IPV and other intervention services. However, SBA and four or more ANC were less likely among women experiencing physical IPV. Efforts to ensure that women who are experiencing IPV are able to access health services are needed. Women living in an Ananya program district, a program that aims to increase access to and quality of maternal and child health services, had higher odds of all assessed PNH practices, except postnatal care, regardless of IPV exposure. Postnatal care within 48 h of childbirth, though, was not reduced among women exposed to IPV. This finding suggests that beyond being of benefit for neonates of all women, postnatal health services may be an important “touch-point” for victims of IPV, particularly in the past year. Programs like Ananya, and health services such as postnatal care, may offer a potentially important opportunity to provide support and intervene with households to help reduce or mitigate their exposure to IPV and related health vulnerabilities for both new mothers and their neonates [38]. The Ananya program includes the use of community health...
The pattern of IPV experience and postpartum contraception use is unclear. The overall association between IPV and contraception use mirrored findings from other studies, but the type-specific analyses of postpartum contraception use suggests a potentially changing dynamic for the association between contraception type and type of IPV experience or a unique dynamic for postpartum contraception use.

Opportunity for mitigating the negative impact of IPV on PNH behaviors may exist within health care encounters, particularly within postnatal care. Current governmental efforts to increase access and quality of maternal and neonatal health services may also facilitate women experiencing IPV to engage with PNH practices, and as a result, reduce neonatal mortality. Moreover, postnatal health care visits may provide an important opportunity for providing IPV support to victims, which could be built into existing governmental efforts to strengthen quality of care, to reduce IPV and its impact on maternal and neonatal health.

Abbreviations
ANC: Antenatal care; AOR: Adjusted odds ratio; ARRR: Adjusted relative risk ratio; CHW: Community health worker; DHS: Demographic and Health Surveys; EIBF: Early initiation of breastfeeding; IPV: Intimate partner violence; IUD: Intrauterine device; PNH: Postnatal health; SBA: Skilled birth attendant; SC/ST: Scheduled caste/scheduled tribe

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Availability of data and materials
The data that support the findings of this study are available from the Bill & Melinda Gates Foundation (BMGF) but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of BMGF.

Authors’ contributions
SB was involved in the analysis and interpretation of data and led the writing and revisions of the manuscript. LM conducted the analysis and was highly involved in the interpretation of the results and manuscript writing. JS was involved in the analysis, interpretation of results and manuscript development. YA, DD, and KH were involved in the design and implementation of the study, provided input on the analyses and interpretation of results, and were involved in the generation of the manuscript. AR led the conceptualization, analysis, interpretation of results, writing, and revisions related to this manuscript. All authors read and approved the final manuscript.
Ethics approval and consent to participate

Ethical approval for the original evaluation study was provided by India’s Health Ministry Screening Committee (IFRC-IEC-104/11). Ethical approval for this analysis was provided by the University of California, San Diego (#150746). All data were collected by trained female study staff, subsequent to acquisition of written informed consent.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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