Effects of Domestic Violence on Perinatal and Early-Childhood Mortality: Evidence From North India

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Objective. We examined the effect of physical violence during pregnancy on perinatal and early-childhood mortality.

Methods. We estimated the prevalence of domestic violence during pregnancy among a population-based sample of 2199 women in Uttar Pradesh, India. We used a survival regression model to examine the risks for perinatal, neonatal, postneonatal, and early-childhood (aged 1–3 years) mortality by mother's exposure to domestic violence, after we controlled for other sociodemographic and maternal health behavior risk factors.

Results. Eighteen percent of the women in our study experienced domestic violence during their last pregnancy. After we adjusted for other risk factors, births among mothers who had experienced domestic violence had risks for perinatal and neonatal mortality that were 2.59 (95% confidence interval [CI] = 1.35, 4.95) and 2.37 (95% CI = 1.21, 4.62) times higher, respectively, than births among mothers who had not experienced violence. We found no significant associations between domestic violence and either postneonatal or early-childhood mortality.

Conclusions. Domestic violence is a significant risk factor for perinatal and neonatal mortality. (*Am J Public Health.* 2006;96:1423–1428. doi:10.2105/AJPH.2005.066316)

It is estimated that 10% to 69% of women in the world experience some form of violence at the hands of their husband or male partner.[1] Although there is no conclusive evidence that the risk for domestic violence escalates during pregnancy,[2–4] it is clear that a significant subgroup of pregnant women are exposed to violence during pregnancy. The adverse consequences of violence during pregnancy on birth outcomes, such as low birthweight and prematurity, have been extensively studied.[5–12] However, information about the effects of violence on perinatal and early-childhood mortality is much more limited, and almost all such evidence is from studies that were conducted in developed countries.[13–15]

The prevalence of domestic violence among pregnant women in US studies ranges from 1% to as high as 20%, with most studies reporting a range of 4% to 8%.[16] Although more limited in number, studies that were conducted in developing countries have reported prevalence rates that range from 4% to as high as 28%.[17] Infant mortality rates also are substantially higher in developing countries; today, more than 90% of neonatal deaths occur in these countries. Despite higher levels of both domestic violence and childhood mortality in developing countries, information about the association between domestic violence and child mortality in these countries is limited.[18,19]

The pathways through which domestic violence may lead to elevated risks for perinatal and childhood mortality are not fully understood. One possible pathway is the direct effect of blunt physical trauma and the resultant fetal death or subsequent adverse pregnancy outcome.[6,20] A second potential pathway is elevated maternal stress levels and poor nutrition, both of which are associated with low birthweight or preterm delivery and are well-known risk factors for perinatal and infant mortality.[21–23] A third possible pathway is the deterrent effect of violence on women's use of preventive or curative health services during pregnancy, delivery, and after the birth.[24–26]

Data from Uttar Pradesh, North India—where there are high levels of both domestic violence within marriage[18,27] and early childhood mortality levels[28,29]—provided a unique opportunity for investigating this association. Our objectives were to (1) examine the bivariate association between domestic violence and mortality risks during early childhood, (2) investigate the association between domestic violence and maternal health care behaviors, and (3) explore the association between domestic violence and perinatal, neonatal, postneonatal, and early-childhood mortality risks, after we controlled for the effects of maternal health care behaviors and other sociodemographic characteristics.

METHODS

We used matched husband and wife data from 2 surveys that were conducted in Uttar Pradesh between 1995 and 1996: the PERFORM System of Indicators Survey of women and the Male Reproductive Health Survey. Uttar Pradesh, the most populous state in India, ranks near the bottom of all Indian states in terms of social and economic development levels; for example, 80% of its population is rural, and 57% of its females are illiterate. The fertility rate between 1998 and 1999 was 4.8 children per woman, a figure roughly 40% higher than the national average. Almost all women get married, and they often get married at very young ages, with 40% of females aged 15 to 19 years already married. Educational facilities are not available in one third of the villages, and in three fourths of the villages, the nearest health facility is 5 or more kilometers away.[29]

The PERFORM survey used a stratified multistage cluster sample design of households that yielded an overall sample of 45 277 reproductive-aged women in 28 districts of Uttar Pradesh. The Male Reproductive Health Survey was conducted approximately 6 months later. The sampling frame for this latter survey comprised all husbands in households identified during the first-stage sample in 5 of the original 28 sampled districts. Eligibility criteria for men included

being currently married, residing with their wife, and being between 15 and 59 years of age, which resulted in a final sample of 6606 husbands. Details about both surveys have been published elsewhere.[30] We used relationship-to-head-of-household codes to successfully match the records of 5553 husbands (84.1%) with survey data for their wives. A separate analysis indicated that the matched and unmatched cases were very similar in terms of sociodemographic characteristics (data not shown). The sample for our study comprised the 2199 pregnancy outcomes that occurred during the 3-year period before the women's survey. Among women who had multiple pregnancies during this period, only the most recent pregnancy outcome was considered.

The questionnaire for the male survey was administered by trained male interviewers, either within a private area of the home or outside the home. The survey covered a wide range of issues about household socioeconomic and demographic status, contraceptive knowledge and behavior, health expenditures, and reproductive health. The survey also included a series of detailed questions about the husband's perpetration of physical violence against his wife, which was the focus of our study. Husbands were asked whether they had ever physically hit, slapped, or kicked their wives; the initial and most recent timings of such physical violence; and the total number of episodes that had occurred. No direct question asked whether the husbands had been physically violent with their wives during the most recent pregnancy. We used data from the wives' sample on the date of the most recent pregnancy outcome and juxtaposed the pregnancy interval with the date of first and most recent period of reported physical violence. We classified women as having experienced domestic violence if their husband reported that the timing of domestic violence commenced either before or during this pregnancy and continued for part or all of the pregnancy.

Our mortality outcome measures were derived from data collected in the women's survey. A detailed pregnancy history for the 3 years immediately preceding the interview was included in this survey, which collected information on all pregnancies, pregnancy outcomes, and subsequent deaths. The outcome status of each known pregnancy was recorded as an early fetal loss, stillbirth, or live birth. Those women who initially reported a stillbirth were further queried about whether the child had shown any movement or breathing immediately after birth to reduce misclassification of live births as stillbirths. Age at death was recorded in days for children who died during the first month of life, in months for deaths during the first year, and in years for deaths after the first year.

This information was used to calculate perinatal (stillbirths and deaths during the first 7 days of life), neonatal (deaths within the first month of life), postneonatal (deaths after first month but before completion of the first year of life), infant (deaths before completion of the first year of life, ${}_1q_0$) and early-childhood (deaths between the first and third year of life, ${}_3q_1$) mortality rates. Also included in the pregnancy history were detailed questions about prenatal care, delivery care, and postpartum care from trained health personnel and the woman's acceptance of tetanus toxoid immunization for each reported pregnancy outcome. Each of these 4 variables was used as an outcome for the health care–seeking behavior analysis (to examine the question of whether domestic violence deters maternal health care use) and as an independent variable for child mortality–related outcome analysis (to examine the question of whether domestic violence is a risk factor for early-childhood mortality after we controlled for maternal health care behaviors and other covariates).

All violence-related variables were obtained from data collected in the male survey. The multivariate models were adjusted for the effects of mother's age, parity, mother's and father's education, socioeconomic status, caste, whether the pregnancy/child was wanted, and the set of variables that reflected maternal health care behaviors (prenatal care, maternal tetanus toxoid immunization, institutional delivery for perinatal and neonatal mortality, and postpartum care for only the postneonatal and early-childhood mortality models).

We initially examined differentials in child survival probabilities by maternal exposure to domestic violence with the Kaplan–Meier life table method. The similarities in survival curves were compared with both the Wilcoxon signed rank and log-rank tests. In the log-rank test, deaths were equally weighted, and in the Wilcoxon test, early deaths were weighted more heavily than later deaths. Because deaths during childhood were more concentrated during the earlier period, we are presenting the Wilcoxon χ^2 results. All childhood mortality rates were estimated as death probabilities between age x and n from the life table where

$$(1)\quad {}_nq_x = 1 - \sum_{i=x}^{i=x+n}(1-q_i),$$

where q_i is the mortality risk at age i, and

$$(2)\quad \sum_{i=x}^{i=x+n}(1-q_i),$$

equals survival probability at age n.

We used logistic regression models to examine the effects of domestic violence on selected maternal health care behaviors. To explore the effects of domestic violence on early-childhood mortality, we used time-to-event analysis with Cox proportional hazards models. Because the surveys were constructed on the basis of a stratified multistage cluster sampling design, we estimated consistent standard errors to take into account higher intraclass correlation at cluster level observations and to avoid spurious rejection of null hypotheses because of underestimated naïve standard errors. For the Cox proportional hazards models of mortality outcomes, we used the Wei and Lin method, which is a marginal-model specification.[31] For the logistic regression models of maternal health care behaviors, we used Taylor's linearization method for variance estimation.[32] We used Stata 8 software (Stata Corp, College Station, Tex) for all analyses.

Additionally, we estimated the population attributable fraction (PAF) to assess the hypothetically expected reduction in incidence of early-childhood mortality that would be achieved if mothers had been entirely unexposed to domestic violence compared with the current level of exposure.[33] In terms of incidence, PAF is expressed as $(I_p\text{-}I_r)/I_p$, where I_p is actual population incidence and I_r is the expected incidence when the exposure

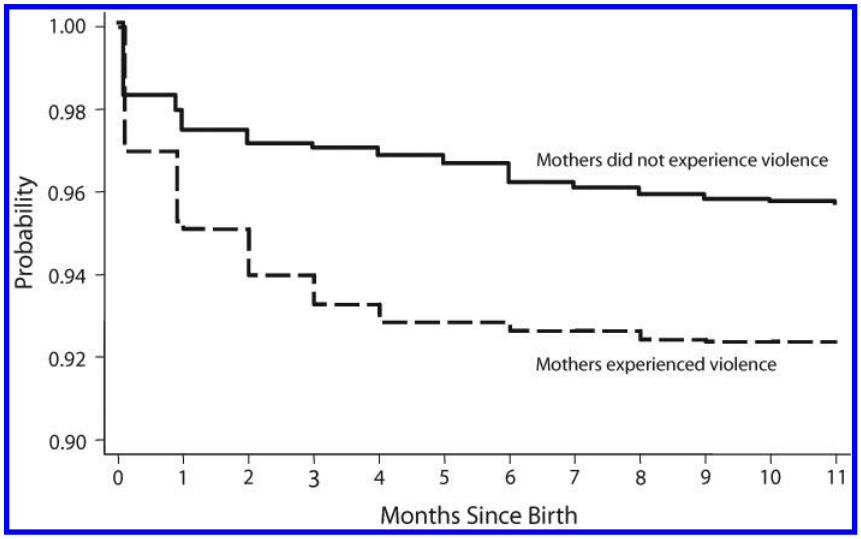

FIGURE 1—Survival probabilities of children by mothers' violence experience.

is eliminated. Equivalently, PAF=(R−1)/R, where R is the incidence risk ratio (I_p/I_r).

RESULTS

The study sample primarily consisted of younger women (mean age 27.4±6.1 SD) who had high parity (mean number of children ever born 3.6±2.3 SD) and no formal education (70.5%). Respondents' husbands were on average 5 years older than the female study participants (mean age of husband 32.4±7.2 SD). Among the 2199 pregnancy outcomes, 402 (18.3%) occurred among women who were classified as having experienced domestic violence during their most recent pregnancy.

Figure 1 shows the Kaplan–Meier survival curves for infants aged 0 to 11 months by mother's domestic violence experience. Overall, the survival probabilities for infants were significantly lower among women who experienced domestic violence (Wilcoxon χ^2=4.72; *P*=.030). Table 1 shows specific infant and early-childhood mortality rates by exposure to violence. The most pronounced differentials in mortality rates were during the earliest period of life. Both perinatal and neonatal mortality rates were almost twice as high among women who experienced domestic violence than among women who did not experience domestic violence (perinatal mortality: 49.4 vs 24.3 per 1000 births, *P*=.007; neonatal mortality: 49.5 vs 26.1 per 1000 live births, *P*=.014). The association between domestic violence and childhood mortality risks weakens as children age, with both postneonatal and early-childhood mortality rates no longer significantly associated with mother's exposure to violence. Overall, the risk for infant mortality was 36% higher among mothers who experienced domestic violence compared with mothers who did not experience violence (77.1 vs 56.9 per 1000 live births, *P*=.063).

One plausible way that domestic violence might influence childhood mortality risks is the effect of violence on maternal health care behaviors during and immediately after pregnancy. Table 2 shows the association between domestic violence during pregnancy and selected maternal health care behaviors—prenatal care, maternal tetanus toxoid immunization, institutional delivery care, and postnatal care. Although all 4 indicators of maternal health care behavior were significantly lower among women who experienced domestic violence at the unadjusted level, when controls were introduced for other sociodemographic characteristics, only the effect of violence on prenatal care (odds ratio [OR]=0.68; 95% confidence interval [CI]=0.50, 0.93) remained statistically significant.

The Cox proportional hazards regression models of the effects of maternal exposure to domestic violence on the risks for infant and early-childhood mortality are shown in Table 3. After we adjusted for other risk factors, women who experienced domestic violence during pregnancy experienced significantly higher risks for both perinatal (hazards ratio [HR]=2.53; 95% CI=1.35, 4.74) and neonatal mortality (HR=2.31; 95% CI=1.19, 4.50). However, there was no excessive mortality risk during the postneonatal and early-childhood periods by mother's exposure to domestic violence (neither effect was statistically significant).

The regression coefficients of other control covariates (data not shown) suggest that perinatal and neonatal mortality risks were significantly higher among mothers who gave birth for the first time (HR=3.74;

TABLE 1—Childhood Mortality Rates, by Mother's Exposure to Domestic Violence: Uttar Pradesh, India; 1995–1996

	Not Exposed to Violence		Exposed to Violence		
Period of Mortality	No.	Mortality Rate per 1000 Live Births (95% Confidence Interval)	No.	Mortality Rate per 1000 Live Births (95% Confidence Interval)	Wilcoxon χ^2 *P*-value
Perinatal[a]	1802	24.3 (18.1, 29.2)	397	49.4 (32.0, 75.9)	0.007
Neonatal	1793	26.1 (19.6, 34.6)	389	49.5 (32.0, 76.3)	0.014
Postneonatal	1735	31.7 (23.9, 41.9)	369	29.1 (15.9, 52.8)	0.923
Infant ($_1^q{}_0$)	1793	56.9 (46.7, 69.2)	389	77.1 (54.5, 108.7)	0.063
Child ($_3^q{}_1$)	1270	5.0 (1.8, 13.9)	262	7.0 (1.1, 44.1)	0.760

[a]Per 1000 live and stillbirths; other rates were based on live births.

TABLE 2—Logistic Regression Results for Domestic Violence and Use of Maternal Health Care: Uttar Pradesh, India; 1995–1996

Maternal Care	No.	Crude Odds Ratio (95% Confidence Interval)	Adjusted[a] Odds Ratio (95% Confidence Interval)
Antenatal care	2199	0.51 (0.38, 0.68)	0.68 (0.50, 0.93)
Tetanus toxoid immunization	2199	0.64 (0.50, 0.84)	0.89 (0.66, 1.20)
Delivery care	2199	0.51 (0.30, 0.87)	1.12 (0.61, 2.04)
Postpartum care	2182	0.54 (0.34, 0.85)	0.78 (0.47, 1.30)

[a]Adjusted for women's age, parity, women's education, husband's education, socioeconomic status, caste, gender, and whether the pregnancy/child was wanted.

TABLE 3—Hazards Model Results for Domestic Violence and Early-Childhood Mortality: Uttar Pradesh, India; 1995–1996

Mortality	No.	Crude Hazards Ratio (95% Confidence Interval)	Adjusted[a] Hazards Ratio (95% Confidence Interval)
Perinatal	2199	2.05 (1.08, 3.89)	2.53 (1.35, 4.74)
Neonatal	2182	1.92 (1.00, 3.68)	2.31 (1.19, 4.50)
Postneonatal	2104	1.03 (0.46, 2.30)	1.00 (0.44, 2.27)
Child ($_3^q{}_1$)	1586	1.38 (0.22, 8.77)	0.94 (0.12, 7.15)

[a]Adjusted for women's age, parity, women's education, husband's education, socioeconomic status, caste, gender, whether the pregnancy/child was wanted, prenatal care, tetanus toxoid immunization, delivery at an institutional facility, and postpartum care.

95% CI=1.59, 8.85 and HR=3.36; 95% CI=1.39, 8.12, respectively), and perinatal mortality risk was lower among mothers who had some education (HR= 0.28; 95% CI=0.09, 0.81). The risk for perinatal and early-childhood mortality ($_3^q{}_1$) was significantly lower among women who had higher socioeconomic status (HR=0.72; 95% CI= 0.53, 0.97 and HR=0.46; 95% CI=0.25, 0.87, respectively). Maternal health care variables were not statistically significant for preventing childhood mortality.

We also estimated the PAF to evaluate the effect of eliminating domestic violence on potential reductions in perinatal and neonatal mortality. The PAF was 18% (95% CI=3%, 30%) for perinatal mortality and 17% (95% CI=3%, 29%) for neonatal mortality. The overall PAF for perinatal and neonatal mortality was 18% (95% CI=6%, 29%), which indicates that approximately 1 in 5 stillbirths and deaths during the first month of life could potentially have been prevented if domestic violence was eliminated.

DISCUSSION

Instead of being a protected time, pregnancy is a time of continuing risk for domestic violence for many women. Our study results add to the currently limited number of studies conducted in developing countries that have shown domestic violence during pregnancy has adverse consequences for infant and early-childhood mortality. Almost 1 in 5 study participants experienced physical violence by their husbands during their most recent pregnancy. We found the risks for both perinatal and neonatal mortality were more than 2-fold higher among births to mothers who experienced such violence. Although more research is clearly warranted, our finding that the effects of violence attenuate as the child ages, and that the early-mortality effects of violence persisted after we controlled for variables that measured maternal health care behavior, are consistent with the conclusion that this effect may be more physiological than behavioral in nature.

It is interesting to compare our findings with previous developing-country studies of domestic violence and childhood mortality. In the study most relevant to ours, an Indian study reported roughly a 2-fold higher risk for both fetal and infant death among pregnant women who reported lifetime domestic violence, with effects somewhat stronger in the North Indian state of Uttar Pradesh than in the South Indian state of Tamil Nadu.[18] Similarly, a case-referent study conducted in Nicaragua found roughly 8-fold and 6-fold higher risks for infant (0–11 months) and early-childhood (0–59 months) mortality, respectively, among births whose mothers experienced lifetime physical and sexual intimate-partner violence.[19] A separate study of prenatal clinic patients in a Chinese community, however, reported no association between domestic violence by male partners (defined in that study as primarily psychological in the form of threats of abuse without physical injury) and pregnancy outcomes.

The fact that our measure of domestic violence was determined on the basis of husbands' responses is both a potential strength of and a limitation to our study. Its strength is derived from the fact that our measure of violence was reported by a separate and independent source (husbands) than that for the primary outcome of interest in our study—childhood mortality (women). A potential limitation is that obtaining data on the occurrence of male-to-female violence from the perpetrators of such violence raises concerns about possible underreporting of this behavior. Previous studies from other settings, however, indicate comparable aggregate levels in men's and women's reports of recent domestic violence.[35–37] Moreover, the prevalence levels of violence obtained from our survey of husbands were comparable with those reported in previous community-based and hospital-based studies of women in North India,[18,29,38,39] which suggests that to the extent it is present, underreporting of violence may not be appreciable.

An additional limitation to our study is the measurement of domestic violence. Because there was no direct question about whether physical violence took place during the pregnancy of interest, we had to match data on the reported timing of the initiation and cessation of violence toward wives with data on

the timing of the most recent pregnancy. Additionally, in a retrospective study such as ours, the issue of recall—about both the occurrence and the specific timing of onset and termination of violence—raises the possibility of misclassification of our primary exposure variable—violence during pregnancy—if such violence actually took place when the woman was not pregnant.

A final possible limitation to our study is that our mortality outcome variables were derived from retrospective reports by mothers, and both pregnancies and deaths may have been underreported. Although we cannot rule out this possibility, infant mortality levels across the 5 study districts were broadly similar to the levels that were reported in a separate district-level analysis.[40] Moreover, the fact that our exposure variable—violence during pregnancy—was obtained from a source (husbands) separate from our outcome variable of childhood mortality (wives) makes any systematic bias associated with underreporting unlikely.

Although additional research is clearly needed, our findings have potentially significant implications for current public health programs in developing countries. Efforts to reduce levels of domestic violence—through channels such as public education, legal reform, and community action—are in very early stages in almost all developing countries. Women's freedom from such violence is a fundamental human and reproductive right. Our findings contribute additional impetus to the importance of domestic violence prevention by providing some of the most conclusive evidence to date about the adverse consequences of violence during pregnancy for subsequent child survival. It is noteworthy that, to date, the issue of domestic violence has remained largely outside the purview of child survival programs. Although significant progress has been made during the past 2 decades in reducing levels of childhood mortality in developing countries, the levels of perinatal and neonatal mortality remain high in low-resource areas such as North India.[41] Addressing the issue of domestic violence within such programs will further reduce preventable early mortality in these areas. Our finding that almost 1 in 5 perinatal and neonatal deaths could have been prevented with the elimination of domestic violence compares favorably with the impact of other child survival interventions.[42] Our results underscore the need for public education and awareness programs that highlight the serious and negative consequences of domestic violence for the health and well-being of both mothers and their children. ■

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S. Ahmed and M. A. Koenig analyzed the data, interpreted the results, and wrote the text. R. Stephenson reviewed the article and contributed significantly to the completion of this study.

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