Gender-Based Disparities in Infant and Child Mortality Based on Maternal Exposure to Spousal Violence

The Heavy Burden Borne by Indian Girls

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Objectives: To examine associations between intimate partner violence (IPV) against Indian women and risk of death among their infants and children, as well as related gender-based disparities.

Design: Analyses of nationally representative data to estimate adjusted hazard ratios (aHRs) and attributable risks for infant and child mortality based on child gender and on IPV against mothers.

Setting: India.

Participants: Women aged 15 to 49 years (n=59 467) across all 29 Indian states participating in the Indian National Family Health Survey 3 provided information about 158 439 births and about infant and child mortality occurring during the 20 years before the survey.

Main Outcome Measures: Maternal IPV and infant and child (<5 years) mortality among boy vs girl children.

Results: Infant mortality was greater among infants whose mothers experienced IPV (79.2 of 1000 births) vs those whose mothers did not experience IPV (59.1 of 1000 births) (aHR, 1.09; 95% confidence interval [CI], 1.03-1.15); this effect was significant only for girls (1.15; 1.07-1.24; for boys, 1.04; 0.97-1.11). Child mortality was also greater among children whose mothers experienced IPV (103.6 of 1000 births) vs those whose mothers did not experience IPV (74.8 per 1000 births) (aHR, 1.10; 95% CI, 1.05-1.15); again, this effect was significant only for girls (1.14; 1.07-1.21; for boys, 1.05; 0.99-1.12). An estimated 58 021 infant girl deaths and 89 264 girl child deaths were related to spousal violence against wives annually, or approximately 1.2 million female infant deaths and 1.8 million girl deaths in India between December 1985 and August 2005.

Conclusion: Intimate partner violence against women should be considered an urgent priority within programs and policies aimed at maximizing survival of children in India, particularly those attempting to increase the survival of girls 5 years and younger.

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APPROXIMATELY 10 MILLION children die across the globe each year before their fifth birthday.[1] One in 5 of these children (2.1 million) die in India.[1,2] Child mortality is a stubborn problem across South Asia. With more than 8% of live births estimated to end in death before age 5 years,[1,3] the region is failing to meet Millennium Development Goal 4 (reducing child mortality by two-thirds from 1990 to 2015).[1] As other regions in Asia have made greater strides toward this goal, South Asia's fraction of infant deaths has steadily risen, now estimated at approximately 80%.[1] With India alone contributing more than one-quarter of all births worldwide each year,[1] reductions in national infant and child mortality, even of a modest magnitude, are critical.

Multiple infant and child mortality risk factors have been well documented (eg, malnutrition, low birth weight, and infectious disease)[4-7]; however, less attention has been paid to the potential role of violence against mothers of infants and children. Violence from husbands has been implicated in child malnutrition,[8,9] low birth weight,[10,11] and infectious disease,[12] as well as direct violence against a child,[13] suggesting its role in mortality outcomes. Investigation into the role of intimate partner violence (IPV) in mortality outcomes is indicated in India given its high prevalence of spousal violence against wives (>1 in 3),[14,15] coupled with high rates of infant and child mortality.[1]

Gender disparity constitutes a critical yet understudied issue regarding Indian infant and child mortality. Differential mal-

treatment of girls vs boys has been discussed extensively,[1,7,16-18] and millions of girls have been described as "missing" in the population.[19] The high ratio of male births to female births in India[20] is thought to reflect sex-selective abortion and undocumented female infanticide and other female infant death.[5,16,19,21,22] These gender-based disparities extend to child mortality in India[23]; an estimated 70 of 1000 boys born will die before age 5 years, while this estimate is 13% higher for girls at 79 of 1000 born.[1] Notably, the pattern in India is the reverse of that found globally (ie, child survival is greater for girls in most other nations[24,25]).

To date, there has been little empirical assessment as to whether and to what extent spousal violence affects the likelihood of infant and child survival. Four district or community-based studies have explored this question to date, 2 studies[26,27] in rural districts of the Indian states of Uttar Pradesh and Tamil Nadu, 1 study[28] in a rural district in Bangladesh, and 1 case-control study[29] in Leon, Nicaragua. Results of 3 of these studies[26,27,29] using mothers as the unit of analysis indicate that a woman's history of violence from a male partner increases the likelihood of infant or child mortality. The single study[28] of community-based data that assessed the association of violence against mothers with the risk of child mortality at the child level rather than at the maternal level found no overall elevated risk of mortality conferred by such violence. A 2009 study[30] examined this relationship using Indian data and found evidence of an association, but the findings cannot be considered nationally representative because sample weights were not used; furthermore, the analyses were not stratified by child gender.

To advance the state of knowledge, this study used a large national data set weighted to provide a nationally representative sample of mothers' reports of infant and child deaths in India collected via the Indian National Family Health Survey 3 (NFHS-3) between November 2005 and August 2006. Analyses were conducted to (1) assess whether violence against mothers was related to elevated rates of infant and child (aged <5 years) mortality, (2) evaluate if such rates differed for girls vs boys, and (3) explore the extent to which recent national census statistics reflect such mortality rates and related gender-based disparities.

METHODS

DESIGN, SETTING, AND SAMPLE

From November 2005 to August 2006, the NFHS-3 was conducted in all 29 Indian states by the International Institute for Population Sciences and Macro International.[15] The NFHS, also referred to as the Demographic Health Survey in other national contexts, is conducted regularly in many developing countries to obtain population-based estimates of major health threats. This surveillance involves confidential questionnaires administered verbally in private locations within sampled households; surveys were bilingual within each state, with questions available in English and in the principal language of that Indian state. The nationally representative household-based sample for the NFHS-3 was created via a stratified multistage cluster strategy. Within each state, 2-stage (rural areas) and 3-stage (urban areas) procedures identified 3850 primary sampling units comprising 1 or more vil-

lages in rural areas and census enumeration blocks within wards in urban areas; primary sampling unit selection probability was proportional to population size. Within each primary sampling unit, household enumeration generated the sampling frame for systematic selection of households. Trained research assistants conducted household-based recruitment and obtained written informed consent immediately before survey data collection. Further details concerning the NFHS-3 procedures have been published previously.[15]

These procedures identified 131 596 eligible women in India aged 15 to 49 years, of whom 124 385 completed the survey (response rate, 94.5%).[15] Although the overall sampling strategy allowed for multiple female participants per household, a separate systematic procedure selected a single female participant to complete the IPV assessment. This assessment was conducted by female interviewers only when the privacy of the respondent was guaranteed.[31] All interview responses were kept strictly confidential and were not shared with other members of the household. This procedure was designed to maximize participant confidentiality in responding to sensitive items concerning violence victimization and to prevent risk to any individual based on subsequent discussion of the assessment among participating household members. Of 124 385 female survey participants, 84 268 (67.7%) were selected for the IPV module, and 83 703 of these (99.3%) completed the module. Each participant was asked to enumerate the births of their children, including gender, current age, and age at death if applicable. Among 83 703 women who completed the IPV assessment, 63 356 had given birth; these participants provided birth information about 187 351 children, which serve as the unit of analysis for the present investigation. The analytic sample was further restricted to births within the past 20 years (n=159 053) to maximize inferences to the current population while retaining statistical power. Six hundred fourteen births with incomplete data concerning violence exposure were excluded, resulting in a final sample size of 59 467 mothers and 158 439 births.

MEASURES

Maternal demographics, including age, parity, and education, were assessed via single self-reported items. A relative index of household wealth was calculated based on interviewer-observed assets (eg, ownership of consumer items), with resulting scores divided into quintiles (1 indicated the lowest level of household wealth; 5, the highest level of household wealth). The primary exposure, IPV, was assessed via self-report in accord with World Health Organization recommendations[32,33] and was based on the Revised Conflict Tactics Scale.[34] Lifetime IPV victimization was indicated by a positive answer to any of 8 items pertaining to whether their current husband had performed the following: "push you, shake you, or throw something at you"; "slap you"; "punch you with a fist or something harmful"; "kick, drag, or beat you up"; "try to choke or burn you on purpose"; "threaten or attack you with a knife, gun, or any other weapon"; "physically force you to have sexual intercourse with him even when you did not want to"; or "force you to perform any sexual acts that you did not want to." Items demonstrated adequate internal consistency reliability; Cronbach α was .76 for the sample. Infant and child mortality outcomes were assessed via participant enumeration of each live birth, including date of birth, current age, and age at death if applicable; consistent with international standards, infant mortality was defined as death before age 12 months, and child mortality was defined as death before age 60 months.

All data collection procedures were approved by the ORC Macro International Institutional Review Board. The Harvard School of Public Health Human Subjects Committee deemed secondary analyses exempt given the anonymous nature of the data.

Variable	Total Sample, % (95% CI)	IPV Exposed, % (95% CI)[b]
Overall	**100**	34.1 (33.6-34.6)
Maternal age, y		
<25	18.5 (18.1-18.9)	34.4 (33.3-35.6)
25-29	21.3 (20.9-21.7)	34.9 (33.2-35.0)
30-34	20.6 (20.2-20.9)	34.0 (33.1-34.9)
35-39	18.8 (18.4-19.2)	34.8 (33.8-35.9)
40-44	13.6 (13.3-14.0)	33.0 (31.7-34.4)
≥45	7.2 (6.9-7.5)	33.7 (31.8-35.6)
Highest level of education achieved		
No education	43.9 (43.4-44.4)	43.6 (42.9-44.4)
Primary	16.0 (15.6-16.3)	37.5 (36.3-38.7)
Secondary	33.8 (33.4-34.3)	24.6 (23.9-25.3)
Higher	6.3 (6.1-6.5)	10.0 (9.0-11.1)
Household wealth index		
Poorest	16.3 (15.9-16.6)	48.3 (47.1-49.5)
Poor	18.5 (18.4-18.9)	43.8 (42.7-45.0)
Middle	21.1 (20.7-21.5)	37.5 (36.5-38.6)
Richer	21.5 (21.1-21.9)	30.4 (29.5-31.4)
Richest	22.7 (22.3-23.1)	16.3 (15.5-17.0)
Dwelling		
Urban	31.9 (31.5-32.3)	28.2 (27.5-29.0)
Rural	68.1 (67.7-68.5)	36.8 (36.3-37.4)

Abbreviations: CI, confidence interval; IPV, intimate partner violence.

[a] The mean (SE) parity was 3.10 (0.01) for the total sample and 3.50 (0.02) for the IPV exposed ($P < .001$, Pearson product moment χ^2 test).

[b] Row percentages. P values (Pearson product moment χ^2 test) are .41 for maternal age and <.001 for highest level of education achieved, household wealth index, and dwelling.

STATISTICAL ANALYSIS

Prevalence estimates of maternal IPV victimization were calculated for the total sample of mothers (n=59 467). Differences in IPV prevalence based on demographics were assessed using the Wald χ^2 analysis; significance for all analyses was set at $P < .05$.

Infant and child mortality rates per 1000 live births were calculated for the total sample of births (n=158 439) and by gender overall and stratified based on maternal exposure to IPV. The vital statistics method was chosen for the analyses (ie, the proportion of deaths per live births) rather than derivation of mortality via calculation of component death rates, as is practiced by Macro International. Because both methods of mortality rate calculation are limited by several potentially false assumptions (eg, accurate reporting of exact month-level date of a child's death and linear changes in mortality), the vital statistics method was chosen because of its ability to describe the actual number of deaths per 1000 births. Time-to-event analysis using Cox proportional hazards models was conducted to evaluate the association of maternal exposure to IPV with infant and child mortality using person-months as the unit of time. Models were subsequently adjusted for maternal demographic covariates (maternal age, educational status, parity, rural dwelling, and household wealth index). Effect modification by gender was assessed by creating an interaction term of maternal exposure to IPV and child gender and by including it in the multivariate-adjusted Cox proportional hazards model. The interaction term was evaluated using the Wald χ^2 analysis. Finally, adjusted hazard ratios (aHRs) were used to calculate the population-attributable fraction (PAF) to estimate the fractions of all infant and child mortality cases that would not have

occurred in the absence of maternal violence (overall and by child gender). The PAF was calculated using the following computation: $p_c([RR-1]/RR)$, where p_c represents the IPV prevalence among the cases, and RR indicates risk ratio.[35,36] To estimate the effect of IPV on infant and child mortality during the 20-year period (December 1985 to August 2005), the PAF was then multiplied by the corresponding annual numbers of infant and child births and deaths by gender that occurred during that period.[15,20,37-39]

All analyses were performed using commercially available statistical software (SAS version 10.0; SAS Institute, Cary, North Carolina); survey analysis procedures were used to accommodate the stratified cluster sampling design of the NFHS-3 and the potential for nonindependence of responses within primary sampling units. Analyses were weighted for nonresponse using the nationally representative women's IPV module weights.

RESULTS

IPV PREVALENCE AND ASSOCIATED DEMOGRAPHICS

More than 1 in 3 married Indian women who had given birth in the past 20 years (34.1%) reported having experienced IPV (**Table 1**). This estimate is slightly lower than the 40% prevalence reported for the overall NFHS-3 sample.[15]

INFANT AND CHILD MORTALITY BASED ON IPV EXPOSURE AND CHILD GENDER

Infant mortality was significantly greater among births to mothers experiencing spousal violence (79.2 of 1000 births) vs those who did not experience spousal violence (59.1 of 1000 births) (significance was based on nonoverlapping 95% confidence intervals [CIs]). The aHR for this effect (1.09; 95% CI, 1.03-1.15) indicates an estimated 9% increase in the risk of infant mortality based on maternal violence exposure (**Table 2**).

Analyses stratified by child gender demonstrated that this association was pronounced and significant only for girl infants. Among infant girls, maternal exposure to IPV conferred elevated risk for infant mortality (HR, 1.15; 95% CI, 1.07-1.24), while for infant boys it was nonsignificant (1.04; 0.97-1.11) .

Similarly, children younger than 5 years were significantly more likely to die if their mothers experienced spousal violence (103.6 vs 74.8 deaths per 1000 births) vs those whose mothers did not experience such violence (74.8 of 1000 births). In adjusted Cox proportional hazards regression models, maternal exposure to IPV significantly elevated the risk of child mortality by approximately 10% (aHR, 1.10; 95% CI, 1.05-1.15). Similar to results for infant mortality, analyses stratified by child gender demonstrated that the elevated mortality was borne primarily by girls, with their risk of death by age 5 years increased by 14% based on maternal exposure to IPV (aHR, 1.14; 95% CI, 1.07-1.21). Among boys, IPV was not associated with a significant increase in mortality risk (aHR, 1.05; 95% CI, 0.99-1.12).

In analyses containing an interaction term for child gender and maternal exposure to IPV, the Wald χ^2 analy-

Table 2. Infant and Child (<5 Years) Mortality by Maternal Exposure to Intimate Partner Violence (IPV) Among 158 439 Births (74 054 Female and 84 385 Male)

| Variable | Mortality (95% CI) per 1000 Births[a] | | Hazard Ratio (95% CI) | Adjusted Hazard Ratio (95% CI)[b] | Population-Attributable Fraction (95% CI) for IPV |
	Among IPV Exposed	Among IPV Unexposed			
Infant mortality					
Overall	79.2 (76.3-82.2)	59.1 (57.0-61.1)	1.34 (1.27-1.41)	1.09 (1.03-1.15)	0.0366 (0.0122-0.0604)
Female	76.9 (72.9-81.0)	54.6 (51.8-57.3)	1.42 (1.32-1.53)	1.15 (1.07-1.24)	0.0607 (0.0243-0.0958)
Male	81.4 (77.6-85.3)	63.3 (60.5-66.1)	1.28 (1.20-1.38)	1.04 (0.97-1.11)	. . .
Child (aged <5 y) mortality					
Overall	103.6 (100.3-106.9)	74.8 (72.5-77.2)	1.39 (1.33-1.46)	1.10 (1.05-1.15)	0.0398 (0.0182-0.0610)
Female	105.4 (100.8-110.0)	73.0 (69.9-76.1)	1.46 (1.37-1.55)	1.14 (1.07-1.21)	0.0577 (0.0266-0.0879)
Male	101.9 (97.7-106.2)	76.5 (73.6-79.6)	1.33 (1.26-1.41)	1.05 (0.99-1.12)	. . .

Abbreviations: CI, confidence interval; ellipses, not applicable.
[a] Calculated as the proportion of live births resulting in death multiplied by 1000.
[b] Adjusted for maternal age, education, parity, rural (vs urban) residence, and household wealth index.

sis indicated that the observed differences between girl and boy mortality were statistically significant. *P* values for the interaction terms were .02 for child mortality and .03 for infant mortality.

The PAF was calculated to estimate the potential effect of reducing IPV on rates of infant and child mortality (ie, the fraction of deaths that may be attributable to the direct or indirect effects of IPV); the PAF is estimated only for those effects found to be significant based on hazard ratios. The PAFs were 3.66% (95% CI, 1.22%-6.04%) for overall infant mortality and 6.07% (2.43%-9.58%) for infant girl mortality (Table 2). The PAFs were 3.98% (95% CI, 1.82%-6.10%) for overall child mortality and 5.77% (2.66%-8.79%) for female child mortality. These findings suggest that approximately 1 in 15 deaths of female infants and 1 in 16 deaths of female children could be prevented by eliminating IPV.

To estimate the numbers of infant deaths overall and infant girl deaths attributable to IPV each year across the period studied, as well as across the entire period, PAFs were multiplied by the number of annual infant deaths and infant girl deaths per UNICEF (United Nations International Children's Emergency Fund)[37] and World Health Organization[39] statistics for the midpoint of this interval (ie, 1995). Infant mortality statistics from 1995 closely mirror the means of those derived for 1990 and 2000 and for 1985 and 2005 by the Indian government,[31] indicating the validity of using 1995 mortality statistics in calculating the mean annual mortality (further details about the computations are available from the corresponding author). On the basis of these calculations,[38-40] spousal violence in India against wives may account for 72 617 infant deaths each year across the 20-year period from 1985 to 2005, with girls representing 58 021 of these annual deaths. Considered over the 20-year period under study, spousal violence against mothers is associated with an estimated 1 160 440 girl infant deaths. Using the same method of computation,[38-40] spousal violence in India may be related to approximately 119 480 child deaths each year from 1985 to 2005, with girls representing 89 264 of these annual deaths. Therefore, across the 2 decades studied, violence against mothers is associated with an estimated 1 785 280 female child deaths.

COMMENT

Infants and young children in India were found to suffer significantly greater risk of death in families in which mothers had experienced spousal violence from their husbands. Furthermore, the effect of such gender-based violence was profoundly gendered; infant girls and children bear a far greater share of the mortality burden associated with IPV. In contrast, IPV was not significantly associated with infant boys and child mortality in adjusted analyses. Even after considering the birth of fewer girls than boys in India, deaths of infant girls and young girls accounted for an estimated 80% of all infant deaths and 75% of all child deaths related to IPV, translating to approximately 58 021 infant girls and 89 264 young girls dying each year from 1985 to 2005, or 1.2 million infant girl deaths and 1.8 million girl deaths in India across the 20-year period studied herein.

Violence against mothers may contribute to infant and child mortality by various mechanisms. Evidence of a significant gender differential in this pattern suggests that these mechanisms disproportionately affect girls, likely reflecting the perceived relative lower value of girls vs boys in many Indian families and communities. Moreover, violence against wives may well be a marker for multiple other forms of gender-based maltreatment and neglect of girls (eg, provision of less food, reduced attention to infection prevention, and decreased investment in care for illness).

Because violence against wives is considered an expression of men's sense of entitlement to use violence to control women (including women's care of children),[33,41] it is reasonable to assume that this same belief system informs such men's treatment of their girls.[33,41] Men who perpetrate IPV may well see girls as less deserving of care, leading to inadequate provision of food, hygiene, and other preventive measures, as well as reluctance to invest in the treatment of girls in case of illness; thus, such men ensure that the resources of the family are directed to adult men and sons.[42] In the most extreme forms, violence or mistreatment toward infant girls may take the form of female infanticide.[33,42] Evidence of this gender-based disparity was recently described among a large Indian sample

in which socioeconomic status was associated with the provision of health care only for boys[43]; such effects may be magnified in abusive homes.

Moreover, although child abuse was not assessed herein, it may be that men who are violent against their wives also exhibit violence and mistreatment toward their children.[13] The relative low worth and social and economic costs traditionally associated with girls[44] may make such abuse more likely to extend to girls 5 years and younger.

Abused women may be less able to care for their children based on the emotional and physical sequelae of the violence they have experienced,[45] with such violence being particularly severe following the birth of a girl for the reasons aforementioned.[16,46] The incapacitation of a mother may affect male children to a lesser extent, as family members may be more likely to assist with boys in such cases.[28]

Violence has been found to affect the pregnancy-related health of women and to increase the likelihood of having a low-birth-weight infant.[10,11] However, this explanation does not account for the observed gender disparity in the association of IPV and mortality, as the sex of the child will most likely remain unknown until birth.

Several important limitations of the present study design should be considered in reviewing these findings. The cross-sectional nature of the investigation does not allow for conclusions regarding temporality. In other words, infant and child deaths may precede violence against Indian wives. However, it is unclear why violence would be more likely in cases of the death of a girl 5 years or younger. As discussed, IPV may well be a marker for other gender-related conditions that affect female mortality; to clarify the present findings, longitudinal study regarding a broad spectrum of gender-based maltreatment of women and its potential effects on female child mortality is necessary. Several potential mechanisms underpinning our results were unable to be formally evaluated; data were not collected about the cause of death, abuse of children, or nutritional and health status among children who had died. Such data are needed to better understand the associations identified. Based on the nature of our research question, the present sample was limited to women who were systematically selected for and completed the IPV assessment module. Despite the high participation rate in the IPV module (99.3%), it is possible that this subsample of female participants and, most important, the births they described were in some way nonrepresentative of the larger survey sample and the population. Finally, although child deaths are critical events in life, the reliability of women's recall of such events across the preceding 20 years is unknown.

In summary, the magnitude of the association of IPV perpetration by Indian men with child mortality, as well as the numbers of infants and children who may die based on this modifiable factor, is great; so too is the disproportionate burden borne by young Indian girls. A clear implication of the present findings is the urgent need for IPV against women to be considered an urgent priority within programs and policies aimed at maximizing survival of children in India, particularly those attempting to increase the survival of girls. Violence against mothers[2,29] and the associated gender-based mistreatment of female infants and children[2,23,24] may represent major barriers preventing India from reaching the Millennium Development Goal 4 of a two-thirds reduction in child mortality from 1990 levels by 2015.[1] Regardless of such targets and deadlines, violence against wives in India must be vigorously challenged. Even a modest reduction in the prevalence of IPV may prevent the deaths of tens of thousands of Indian infant girls and children. Such progress may be accomplished by interventions that address gender norms within the context of maternal, neonatal, and child health (eg, antenatal programs for men who are identified as perpetrating IPV).

Our finding that approximately 1 in 15 female infant deaths and 1 in 16 female child deaths may be prevented by eliminating IPV should lead to greater investment in changing discriminatory gender norms among Indian boys and men. Norms should be altered that lead to a broad range of physical and social hazards for women and girls, including gender-based violence and other maltreatment of wives, as well as the associated gendered increase in infant and child mortality suffered by girls born into such families.

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You can't stay in your corner of the Forest waiting for others to come to you. You have to go to them sometimes.
—Winnie the Pooh