

Domestic violence as a risk factor for infant and child mortality: A community-based case–control study from southern India

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ABSTRACT

Background. Violence against women may have an impact on infant and child mortality. We aimed to determine whether domestic violence is a risk factor for infant and child death.

Methods. Eighty infant and child deaths (under 5 years of age) were identified from a central register of a comprehensive community health programme in rural southern India; controls were matched for age, gender and street of residence.

Results. Domestic violence during the lifetime (OR 2.63, 95% CI 1.39–4.99), which was severe (OR 4.00, 95% CI 2.02–7.94) and during pregnancy (OR 5.69, 95% CI 2.03–15.93) and father's smoking status (OR 3.81, 95% CI 1.92–7.55) were significantly related to infant and child death while immunization being completed for age (OR 0.04, 95% CI 0.01–0.19) and having at least one boy child in the family (OR 0.29, 95% CI 0.14–0.59) were protective. These variables remained statistically significantly associated with outcome after adjusting for other determinants using conditional logistic regression.

Conclusion. There is evidence for an association between domestic violence in mothers, and infant and child death.

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INTRODUCTION

The infant mortality rate is considered to be one of the most sensitive indicators of the health status of a community. It continues to be high in India (50/1000 live-births) despite reduction over the past decade.¹ Many factors have been shown to be associated with infant mortality including pneumonia, diarrhoea, malaria, measles and HIV/AIDS.^{2,3} Malnutrition increases the risk in the majority of situations.⁴

The distinction between 'proximate' and 'underlying' determinants of health provides a useful framework to address issues related to generation of cause-specific deaths.⁵ Proximate determinants directly affect child health and survival whereas underlying determinants do so indirectly by modifying proximate determinants. Many of the effects of proximate determinants and the underlying implications of socioeconomic determinants on child health and survival are known.³ While these determinants are unequally distributed across socioeconomic groups, the differences are not entirely attributable to low income. Violence against women, a major public health problem,^{6,7} is also widely prevalent in India,^{8,9}

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and has also been documented to be a risk factor for infant and child mortality.^{10–17} We attempted to investigate the effect of domestic violence on infant mortality using a community-based case–control design in Vellore, Tamil Nadu in southern India.

METHODS

Setting

The Department of Community Health, Christian Medical College, Vellore, India, has been working in Kaniyambadi block for the past 50 years. This region is in the southern state of Tamil Nadu and is a geographically defined area of 127.4 sq. km with an estimated population of about 110 000. The community health programme operates in all villages in the area. A major proportion of the population is from the lower socioeconomic strata. Agriculture and animal husbandry are the main occupations.

Surveillance system

The surveillance system has been described elsewhere in detail.¹⁸ It consists of a 4-tier monitoring system. The block is divided into regions with specific personnel in charge of the health of different regions. The system involves the village health worker, the community health aide, the public health nurse and the doctor. Every week the village health worker reports to the health aide about pregnancies, deliveries, births, deaths, morbidity, marriages, immunization and couples eligible for contraception in the village. This information is verified by the nurse and subsequently by the doctor. Data obtained by the surveillance system are computerized. The programme enumerated the whole population living in the block in 1996 and in 2007 as part of a census. Each person living in the area is given a specific identification number. Data on death are also documented. The causes of death are obtained using verbal autopsy.¹⁹ The data for the whole block are collated and reviewed monthly by the entire health team consisting of community health workers, health aides, community health nurses, doctors and other development staff. This process has been refined over the years.

Details of population

The population at the mid-point for the time period January 2001 to December 2006 was 102 927. During this period, there were a total of 9397 births of which 9225 were live-births. The population of 1–4-year-olds was 38 886. The proportion of antenatal women who received care was 99.7%. The crude birth rate was 13 and there were 172 still-births (18.3/1000) and 157 early neonatal deaths (16.7/1000). The infant death rate for this period was 33.9 per 1000 live-births and the 1–4-year mortality rate was 1.7 per 1000 population. The under-5 mortality rate was 41.2 per 1000 live-births. The ratio of males to females was 1000:1008 and the literacy rate was 71.6%.

Recruitment of cases and controls

We identified cases and controls from a computerized database. Cases were defined as children born alive to women in the area but who died before the age of 5 years, between January 2000 and December 2006. Children living in the same street, matched for age and sex, were identified as controls. The exclusion criteria for both cases and controls were: (i) if the mother was not the primary care-giver, (ii) children from single-parent homes, (iii) children with birth weights <2 kg (as low birth-weight may be due to genetic and biological disease which would confound mortality outcomes), (iv) preterm babies, and (v) babies with congenital anomalies. One control was chosen per case.

One hundred and two consecutive infant deaths (identified by date of death from December 2006 and working backwards) were selected from the database. The following infant deaths were excluded: 2 mothers had died, 3 mothers were single parents, 2 children had congenital abnormalities, 2 mothers had children with birth weights of <2 kg and 13 mothers had moved out of the area or were not available on three occasions.

The cause of death, as determined by verbal autopsies which are part of the surveillance system, in the case group were: pneumonia ($n=24$), acute gastroenteritis ($n=11$), accidental death ($n=7$), meningitis ($n=13$) and early neonatal death ($n=25$). The disease-specific proportionate mortality rates for pneumonia, acute gastroenteritis, accidental death, meningitis and early neonatal death were 29.2, 13.5, 8.5, 15.9 and 30.5, respectively.

Controls, matched for age (± 2 months), gender and street of residence were selected from the database. Two controls selected had birth weights <2 kg and were excluded; 80 cases and 80 controls were included in the study. The mothers of cases and controls were interviewed after obtaining informed consent.

Assessment

The following instruments were used:

1. *The modified abuse assessment screen (mAAS)*: The abuse assessment screen (AAS),²⁰ originally designed to assess abuse during pregnancy, has been modified to assess domestic violence not necessarily restricted to that specific period.²¹ The AAS has been validated for 'present' domestic violence defined as having occurred during the past year. The 5-question mAAS was more accurate and over two times more likely to find victims of ongoing domestic violence than the AAS.²¹ The types of physical violence were defined as follows:

Slap: the use of the assailant's hand on the victim's face

Hit: the use of the assailant's hand on any part of the victim's body other than the face

Kick: the use of the assailant's foot on any part of the victim's body

Beat: repeated hits

Punch: the use of the assailant's fist on any part of the victim's body.

The instrument was translated into the local language (Tamil) and back-translated into English by bilingual health professionals and followed recommended procedures. The instrument was examined by health experts and found to have face and content validity for use in the local population.

2. *Structured clinical interview for DSM III-R patient version (SCID)*.²² The SCID is a standardized and widely used interview schedule for the diagnosis of psychiatric disorders. Current,

past and lifetime diagnoses can be made. The Tamil version has been used in many local studies.²³⁻²⁶

3. *A specifically designed proforma to assess sociodemographic variables and clinical risk factors*. Details of the demographic profile were collected. As financial income in an agrarian society does not reflect socioeconomic status, proxy indicators of socioeconomic status were recorded and include education, employment, housing, debt, ability to buy food, toilets and drinking water supply at home. Clinical details, which affect outcome including details of antenatal care, delivery and immunization were noted. Details of the family environment, which impact child health, morbidity and mortality were documented.

The community health programme run by the institution holds antenatal clinics in every village in the catchment area every 2 weeks. Each mother is given an antenatal card for every pregnancy where data are recorded on weight, blood pressure, presence of anaemia, pedal oedema, abdominal girth, immunizations received, etc. Each child also receives a 'road to health' card, which at various times records weight, height, immunization, etc. Data were obtained from such records.

Attempts at blinding

Cases and controls were extracted from the computerized database. The researcher (SV) assessing the mothers was not aware of the case/control status. The assessment of exposures was done before the assessment of outcome variables. Structured interviews were used to minimize recall bias.

Ethical clearance

The study protocol was cleared by the Institutional Review Board of the Christian Medical College, Vellore.

Statistical analysis

Our outcome variable was infant and child death. The determinants of interest were domestic violence and postpartum maternal depression (DSM III-R major depression). Student *t*-test or the χ^2 test was used to assess the potential association between the determinants of interest and domestic violence. The magnitude of the association between these potential determinants and infant and child mortality was first expressed using crude odds ratios with 95% confidence intervals. Factors known to be associated with infant and child mortality (socioeconomic status, parental education/literacy, Apgar score, immunization completed for age),^{3,5} malnutrition (postpartum depression),²³ domestic violence (father abuses substances; gender bias in local society)⁸ were used in the multivariate statistical procedure to exclude confounding. Conditional logistic regression analysis was done using the following variables: (i) variables of interest: domestic violence and postpartum maternal depression; (ii) Apgar score at birth, immunization completed for age, father's smoking and alcohol abuse status, socioeconomic status, maternal and paternal literacy and number of male children in the family were entered in the model as there was a significant difference between cases and controls.

Statistical significance in the logistic regression models was assessed using the Wald statistic. Both backward and forward inclusion of variables was used in the logistic regression model building procedure to identify the final model. SPSS for Windows 16.0 was used to analyse the data.

The selection of controls from the same street was done to obtain a gross match between cases and controls. However, a

detailed analysis of the socioeconomic data collected shows differences between cases and controls and was adjusted for in the multivariate analysis. A socioeconomic score was used as a single variable in adjustment as we were constrained in the total number of variables, which could be simultaneously used in the multivariate model considering the sample size of the study. The score was derived from the data collected and has been used by other studies from the region.²³

Sample size estimation

A survey of domestic violence in India, including a centre at Vellore, had documented a prevalence of 40%. Assuming domestic violence in mothers with live children to be 40% and an odds ratio of 2.5 for infant mortality in mothers with domestic violence, based on earlier studies in the region²⁷ and in India,⁸ we needed 75 case-control sets (one case to one control) with an 80% power and 5% significance level.

TABLE I. Sociodemographic and clinical characteristics of cases and controls (all values are n[%] unless stated)

Characteristic	Cases (n=80)	Controls (n=80)
<i>Child</i>		
Child's gender (male)	46 (57.5)	46 (57.5)
Mean (SD) birth weight (kg)	2.697 (0.384)	2.793 (0.383)
Immunization completed for age‡	50 (62.5)	78 (97.5)
<i>Pregnancy and delivery</i>		
Place of delivery (hospital)	70 (87.5)	72 (90.0)
Normal vaginal delivery	68 (85.0)	69 (86.2)
Mean (SD) Apgar score‡	8.13 (1.96)	8.96 (0.34)
Tubectomy done after delivery*	22 (27.5)	34 (42.5)
<i>Mother</i>		
Mean (SD) age (years)*	26.68 (4.20)	25.41 (3.29)
Mean (SD) age at marriage (years)	18.89 (2.98)	19.34 (2.82)
Occupation (housewife)	55 (68.8)	64 (80.0)
Literacy (illiterate)	15 (18.8)	9 (11.2)
Mean (SD) years of education*	6.44 (3.78)	7.80 (3.38)
Postnatal depression*	31 (38.8)	17 (21.3)
<i>Father</i>		
Mean (SD) age (years)	34.38 (6.05)	33.02 (4.65)
Mean (SD) years of education*	7.01 (3.63)	8.28 (3.32)
Occupation (unskilled labourer)	37 (46.2)	27 (33.8)
Alcohol use*	50 (62.5)	36 (45.0)
Smoker‡	42 (52.5)	18 (22.5)
<i>Family</i>		
Religion (Hindu)	74 (92.5)	77 (96.2)
Mean (SD) number of children‡	1.52 (0.87)	2.10 (0.81)
Mean (SD) number of living boys*	0.71 (0.77)	1.00 (0.68)
Mean (SD) number of living girls	0.89 (0.87)	1.06 (0.92)
Decision-makers according to mother: husband and in-laws	52 (65.0)	55 (67.7)
<i>Socioeconomic indicators</i>		
House (own)	70 (87.5)	71 (88.8)
House made of mud walls	26 (32.5)	18 (22.5)
Inability to buy food in past month†	40 (50.0)	21 (26.2)
Three square meals per day†	71 (88.8)	80 (100)
Debt (present)	72 (90.0)	64 (80.0)
Drinking water on tap	64 (80.0)	59 (73.8)
Toilet at home	20 (25.0)	29 (36.2)
Socioeconomic status score <7†	37 (46.2)	18 (22.5)
Mean (SD) socioeconomic status score†	8.49 (3.02)	10.00 (3.01)

Chi square test done for categorical and Student t test done for continuous variables * p<0.05 † p<0.01 ‡ p<0.001 ||-categorized using median value

RESULTS

A comparison of the characteristics of cases and controls showed that cases had poorer socioeconomic indices and lower parental education than controls (Table I). They had significantly fewer siblings and brothers and a smaller number of mothers opted for postpartum sterilization. There were a significantly larger number of fathers among the cases with alcohol and tobacco abuse when compared with controls. Their Apgar scores were significantly lower and they had received less immunization for their age compared to controls. There was only one case or one control per family recruited.

The prevalence of postnatal depression was significantly different among mothers of cases and controls (Table I). The other psychiatric diagnoses included psychosis (1 in the case group), history of mania (2 in the case group), anxiety disorder (1 in the case group and 2 mothers among controls) and somatoform disorder (2 mothers among cases and 5 among controls). These differences between case and control groups were not statistically significant.

Physical abuse (slapping, kicking, beating, etc.) and sexual violence were commonly reported in cases and controls with a significantly higher prevalence among the cases (Table II). Nearly all the perpetrators of violence were spouses except in very few instances where the in-laws were also involved. A significant number of women in both groups reported that they were afraid of their husbands with a significant number of cases reporting that violence had a major impact on their lives.

The variables, which were significant on bivariate analysis were considered for the multivariate models. Domestic violence (ever, severe and during pregnancy) and father's smoking status were independent risk factors for infant death while having at least one boy child and immunization completed for age were protective (Table III). Socioeconomic status, maternal and paternal literacy and the father's abuse of alcohol were not significantly related to

TABLE II. Patterns of violence among cases and controls

Pattern of violence	Cases (n=80) n (%)	Controls (n=80) n (%)
Slap ever*	41 (51.2)	27 (33.8)
Slap during last pregnancy†	24 (30.0)	9 (11.2)
Slap following delivery*	21 (26.2)	10 (12.5)
Hit ever†	10 (12.5)	1 (1.2)
Hit during last pregnancy*	5 (6.2)	0 (0.0)
Hit following delivery*	5 (6.2)	0 (0.0)
Punched ever	3 (3.8)	1 (1.2)
Punched during last pregnancy	1 (1.2)	1 (1.2)
Punched following delivery	2 (2.5)	0 (0.0)
Kicked ever*	16 (20.0)	6 (7.5)
Kicked during last pregnancy	11 (13.8)	4 (5.0)
Kicked following delivery‡	14 (17.5)	1 (1.2)
Beaten ever‡	26 (32.5)	9 (11.2)
Beaten during last pregnancy‡	18 (22.5)	2 (2.5)
Beaten following delivery‡	18 (22.5)	3 (3.8)
Hit with instrument used as a weapon†	9 (11.2)	1 (1.2)
Hit with instrument used as a weapon during last pregnancy	3 (3.8)	0 (0.0)
Hit with instrument used as a weapon following delivery	3 (3.8)	0 (0.0)
Forced to have sexual intercourse against will‡	30 (37.5)	12 (15.0)
Afraid of spouse	46 (57.5)	35 (43.8)
Affected by violence: much/very much‡	26 (32.5)	8 (10.0)

* p<0.05 † p<0.01 ‡ p<0.001

TABLE III. Association between determinants and infant/child death outcomes

Model no.	Characteristic	Cases <i>n</i> (%)	Controls <i>n</i> (%)	Odds ratio (OR) (95% CI) p value	Adjusted odds ratio ¹ (95% CI) p value
1	Violence ever	50 (62.5)	31 (38.8)	2.63 (1.39–4.99) 0.003	2.66 (1.21–5.83) 0.015
2	Severe violence	43 (53.8)	18 (22.5)	4.00 (2.02–7.94) <0.001	5.36 (1.64–17.54) 0.005
3	Violence during pregnancy	22 (27.5)	5 (6.2)	5.69 (2.03–15.93) <0.001	4.15 (1.80–9.55) 0.001
3	Immunization completed for age ²	50 (62.5)	78 (97.5)	0.04 (0.01–0.19) <0.001	0.04 (0.008–0.17) <0.001
3	At least one boy child in family ²	43 (53.8)	64 (80.0)	0.29 (0.14–0.59) <0.001	0.25 (0.11–0.59) 0.001
3	Father (smoker) ²	42 (52.5)	18 (22.5)	3.81 (1.92–7.55) <0.001	3.90 (1.72–8.84) 0.001

1. Adjusted for the following variables using backward conditional logistic regression: socioeconomic status; maternal and paternal literacy; at least one boy child in family; father abuses alcohol; father abuses tobacco; immunization completed for age

2. Smoking status of father, immunization completed for age and at least one boy child in family were statistically significant in all models after adjusting for other variables

outcome in the multivariate models. When post-natal depression and Apgar scores were included in the model, domestic violence (ever, severe and during pregnancy) was significantly related to mortality while the maternal psychiatric morbidity and infant health at birth were not related.

DISCUSSION

This study adds to the growing national and international evidence on the impact of maternal intimate partner violence on infant and child mortality.^{10–17} We used a community-based case-control study design to assess the effect of domestic violence on infant and child mortality in a rural southern Indian population.

Prevalence of violence

The prevalence of physical (38.8%) and sexual violence (15%) in the control group was and is similar to other studies from the state and from other parts of India.⁸ The perpetrators of such violence were the spouses. Different types of physical assaults were recorded in both groups with a significantly higher prevalence among cases. Such violence was also present during pregnancy and after delivery. Many women in both groups reported sexual assaults and mentioned that they were frightened of their spouses, reflecting the grossly unequal relationships and the acceptance of violence within the Indian culture.

Risk factors for infant death

We found that infant and child death was associated with domestic violence in mothers. The associations were true for lifetime prevalence, the severity of violence and for physical abuse during pregnancy. The increase in risk with increase in the severity and timing of violence during pregnancy suggests a strong relationship between spousal abuse and infant and child death. This finding is consistent with other epidemiological studies from India.^{15–17}

Substance use in the spouse was also significantly associated with infant and child mortality and is probably a proxy for personality traits and characteristics. The protection offered by adequate immunization for age suggests that the mechanism for the increased risk for death could be through increased health-seeking behaviour in general and the prevention of treatable infections in particular. The prevailing notions of patriarchy increase the pressure on women to deliver boy babies and the failure to conceive a male infant is a well-recognized risk factor for maternal depression during the postpartum period in South Asia.^{28,29} The relationship between infant and child death and the increased gravida and parity of the mother, the larger number of children in the family and the refusal for sterilization after childbirth among cases in this study also reflect the gender bias in Indian society. While postnatal depression and Apgar scores can

be considered intermediaries between violence and infant and child death, these factors were not related to mortality in the multivariate models in this study.

Many mechanisms linking physical violence and infant and under-5 mortality have been mentioned in the literature and include: direct (e.g. trauma) and indirect (e.g. stress and hormone release) increased risk through low birth-weight, negative health and coping behaviours among mothers (e.g. smoking, poor nutrition, rest and medical care), mental health problems (e.g. depression, powerlessness, social isolation) and economic dependence. While effective interventions to improve health of infants and children exist, there are social and cultural barriers to their implementation.²⁷ Focusing on specific health interventions without studying strategies to reduce barriers to their implementation is the major drawback of current approaches. The major barrier to scaling up effective interventions for infant and child health is gender inequality based on sociocultural issues. The systematic discrimination of girls and women based on culture and tradition needs to be tackled if the interventions have to work. Although the short time lag between the (absence of) medical intervention and the health outcomes stand out as causal, it is the longer latent period and the more hazy but ubiquitous and dominant relationship between gender and culture which has a major impact on outcome. Failure to recognize this relationship and refusal to tackle these issues results in poorer health standards of the population. Addressing the factors which are prevalent in cultures with a high prevalence of domestic violence is mandatory and includes managing economic inequality between genders, changing the pattern of using physical violence for conflict resolution, providing for equal opportunities and authority to women in decision-making and removing restrictions on divorce for women.³⁰ The need to face up to and to change sociocultural stereotypes and traditions is a major public health challenge.

Attempts to overcome limitations of case-control designs

The study has the limitations of a case-control design. The case-control design meant that the study was done at variable times after the child's death. However, the following strategies were used to minimize the limitation of the design: cases and controls were selected using the same reference framework with similar exclusion criteria for unbiased referral and reducing selection bias; the assessor who evaluated the mother did not generate the case-control list and was blind to the status of the child to prevent bias; standard interview schedules were used to reduce recall bias; exposures for violence and for depression were defined before the commencement of the study, were assessed using standard instruments and were elicited before evaluating details about outcome; and multivariate analysis was used to exclude

confounders. The refusal of consent for the study was low and excludes participation bias. Two births of <2 kg were excluded from the study and hence from both the case and control groups. While low birth-weight and preterm birth may be intermediates on the pathway between domestic violence and infant and child mortality, it was felt that there are other causes of low birth-weight (e.g. congenital diseases) that may confound the issue. The use of a population census base and a comprehensive community monitoring system to identify cases and controls reduced many of the limitations often characteristic of case-control studies done in hospital settings.^{23,31}

SCID for DSM III R was used because of the availability of a Tamil version, its use in local community investigations,²³⁻²⁶ familiarity of the investigators with the interview schedule and the absence of major differences with DSM IV. While the use of SCID patient version in community studies may be problematic, it was used to administer a structured interview for diagnosis. SCID has been used in similar studies.³²⁻³⁴ While the likelihood of under-reporting of mental illness was present, the use of a structured interview and diagnostic algorithms for DSM IIR minimized recall and interviewer bias, respectively.

Implications of the study

The study not only documents the prevalence of domestic violence but also establishes the link between violence and infant/child mortality. The prevention of such violence is essential both from a gender perspective and from the point of view of children. In addition to physical morbidity and mortality due to domestic violence, emotional and psychological scars cause significant damage and impact the mental health and lives of mothers and children.

Future research should study the direct and indirect impact and costs of domestic violence, its risk and perpetuating factors, pathways of help-seeking among women faced with such assault and possible avenues for educating communities and for changing social values. The implications of this study suggest the need for interventions to prevent infant and child death by recognizing domestic violence. There is an increasing awareness of domestic violence, which is common in the traditionally patriarchal Indian society. While the legal statutes to prevent domestic violence are in place, there is a need to bring about social change. Working with the community in general and women's groups in particular would be mandatory to reduce such violence. Randomized trials studying the impact of prevention efforts are needed to assess both its effect on the reduction of domestic violence and on infant and child death.

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