ARTICLE

Violence Against Women and Increases in the Risk of Diarrheal Disease and Respiratory Tract Infections in Infancy

A Prospective Cohort Study in Bangladesh

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Objective: To explore whether different forms of violence against women were associated with increased incidence rates of diarrhea and respiratory tract infections among infants.

Design: A 12-month follow-up study embedded in a food and micronutrient supplementation trial.

Setting: Rural Bangladesh.

Participants: Pregnant women and their 3132 liveborn children.

Main Exposure: Maternal exposure to physical, sexual, and emotional violence and level of controlling behavior in the family.

Main Outcome Measures: Infants' risk of falling ill with diarrheal diseases and respiratory tract infections in relation to mothers' exposure to different forms of violence. Adjusted for household economic conditions, mother's education level, parity, and religion.

Results: Fifty percent of the women reported lifetime experience of family violence. Infants of mothers exposed to different forms of family violence had 26% to 37% higher incidence of diarrhea. Any lifetime family violence was positively associated with increased incidence of diarrheal diseases (adjusted rate ratio, 1.20; 95% confidence interval, 1.10-1.30) and lower respiratory tract infections (adjusted rate ratio, 1.31; 95% confidence interval, 1.17-1.46). Further, all forms of family violence were also independently positively associated with infant illness, and the highest incidence rates were found among the daughters of severely physically abused mothers.

Conclusion: Family violence against women was positively associated with an increased risk of falling ill with diarrheal and respiratory tract infections during infancy. The present findings add to increasing evidence of the magnitude of public health consequences of violence against women.

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VIOLENCE AGAINST WOMEN causes serious long-term physical and mental health consequences in exposed women.[1,2] Physical and sexual violence against reproductive-aged women is associated with low-birthweight offspring[3-5] and other perinatal complications.[5,6] Fatal consequences of violence against mothers on children's health have also been found; data from 2 Indian studies indicate an association between physical violence against women and increased neonatal or infant mortality.[7,8] In a case-referent study in Nicaragua, we showed that lifetime physical and sexual violence against women was associated with a 6 times–higher risk of deaths of children younger than 5 years.[9] Further, in a group of educated mothers in rural Bangladesh, exposure to high levels of controlling behavior in marriage or severe physical violence doubled the mortality rates of daughters younger than 5 years.[10]

The literature on consequences of violence against women on young children's morbidity pattern is limited, and weaknesses in study designs and methods preclude causal interpretations. However, there is evidence that violence against women is associated with a risk of lower frequency of immunization of children.[11] Moreover, in a study of 4000 US women, (mostly unmarried) self-perceived impairment of infant health was more commonly reported among mothers exposed to physical partner violence.[12] The only study from a low-income setting to address morbidity among children of abused women is a cross-sectional survey (n=457 mother-infant pairs) in Uganda[13] that reported that lifetime intimate physical and sexual partner violence was associated with overall infant illness and diarrhea.

Table 1. Experience of Violence by the 3132 Rural Bangladeshi Mothers

Type of Violence	Mothers, % (n=3132)
Any violence[a]	50
Lifetime physical violence	22
Lifetime sexual violence	24
Lifetime moderate physical violence[b]	14
Lifetime severe physical violence[c]	8
Physical violence during the pregnancy	8
Lifetime emotional violence[d]	28
Controlling behavior (≥one-fifth of items)	37
High level of controlling behavior[e]	18

[a] Physical, sexual, emotional, or controlling behavior ever.
[b] Includes slaps, throwing things, pushing, or shoving.
[c] Include hitting, kicking, dragging, beating, choking, burning, threatening to use or use of a weapon.
[d] Includes insults, humiliations, threats.
[e] Restricted in 2 or more of the 5 items checked (including restrictions in daily contacts and extreme jealousy).

Violence exposure may interfere with women's caregiving behavior through several pathways, all of which may lead to consequences of infant health. Diminished autonomy, social isolation, and lack of control over financial resources, well-described consequences of an abusive relationship,[2,6] may impair child care as well as lead to insufficient health care seeking. Furthermore, long-lasting mental health consequences for abused women such as stress and depression[1,2,6] might cause disturbances in the emotional interaction between mother and infant and reduced the possibility of mothers meeting the demands of the every-day physical childcare.

In South Asia, gender inequality is prominent[14] and partner violence is commonly reported; in a World Health Organization (WHO)–coordinated study of 1500 rural Bangladeshi women who had ever been married, 69% reported lifetime experience of intimate partner violence.[1,15] The infant mortality rate in Bangladesh has been reduced during the last decades but is still 50 to 60 of 1000 live births, 10 times the level in high-income countries.[16]

Discrimination of female infants was previously pronounced in South Asia[17] and, in some areas, still is.[18] This was manifested in higher frequency of malnutrition of girls and excess female child mortality, explained by differences in rearing and health care–seeking practices for girls and boys.[19,20]

Diarrheal diseases and respiratory tract infections are major causes of infant death in the region[16,21] and contribute to a large extent to overall morbidity among small children.[16,21,22]

This substudy, embedded in a community-based food and micronutrient trial in rural Bangladesh, explores whether different forms of family violence against women (of which intimate partner violence represents >75%)[1] are associated with increased incidence rates of diarrheal and respiratory tract infections among infants. The longitudinal study design, community-based sample, assessment of potential confounding factors, and sample size of more than 3000 live births followed up for 12 months provide unique possibilities for studying the potential effects of violence against women on the morbidity of their offspring.

METHODS

The study site is a rural area in the Bangladesh delta region where a well-established health and demographic surveillance system enables pregnancy identification and longitudinal follow-up. Data emanate from a prenatal food and micronutrient supplementation trial, the Maternal and Infant Nutrition Interventions in Matlab (MINIMat) trial (L. A. Persson, oral communication, 2008), in which all pregnant women in the study area were invited to participate (n=4436). This analysis includes a 12-month follow-up of the live-born children of participating women. Enrollment of women took place from November 2001 to October 2003, and the children were subsequently born from April 2002 to June 2004.

DATA COLLECTION

At enrollment, information was collected on women's age, parity, marital status, educational level (≥7, 3-6, or <3 years of schooling), occupation, and religion. Participants' pregnancies were confirmed with an ultrasound (preferably at a clinic visit at 8-10 weeks' gestational age), and pregnant women were randomly assigned to different food and micronutrient interventions and to either counseling for exclusive breastfeeding or a usual health care message (L. A. Persson, oral communication, 2008). Household economic status was estimated by constructing a wealth index (asset score) using principal component analysis.[23] Scoring factors included ownership of specific items, information on drinking water source, sanitary conditions, and number of rooms. Each household was assigned a standardized score, and the scores were then ranked into quintiles.

In the third trimester women were interviewed regarding experiences of family violence by female field workers who performed the interviews in private and had been trained in collecting this type of information. Ethical and safety guidelines on the conduct of domestic violence research developed by the WHO[24] were followed, and the questionnaire was pretested in the cultural context. A short modified version of the WHO collaborative study questionnaire was used that was based on the Conflict Tactic Scale.[1,25,26] Physical, sexual, and emotional violence and controlling behavior were included, and intimate male partners and/or other family members were considered possible perpetrators. Data on both lifetime and current (during the actual pregnancy) exposure were collected for physical, sexual, and emotional violence. For controlling behavior, only lifetime data were collected. The questions were behaviorally explicit; details on the specific acts or behaviors asked for is given in **Table 1**.

A birth notification system was established among participating women to allow fieldworkers to measure birth anthropometry within 72 hours. Data on newborns' sex, birth weight, birth length, and breast feeding practices were collected. During the first 12 months of life, the mother-child pairs were followed up with monthly home visits. At each visit, mothers were asked to recall infants' illness over the previous week and about any symptom on each of the preceding 7 days. Information was recorded regarding the number and consistency of stools, cough or breathing difficulties, and fever. All symptoms were according to mothers' perceptions without any measurements required. Further, if the infant had any cough or breathing difficulty, additional questions on the presence of rapid breathing and chest indrawings were asked.

A diarrheal disease episode was defined as 3 or more liquid stools per 24 hours. Acute respiratory infection was defined as cough with fever and acute lower respiratory tract infection (pneumonia) as cough or breathing problem with rapid breathing and fever.

STUDY SAMPLE AND EXCLUSIONS

Of 3558 registered singleton live births, 158 were excluded from the follow-up owing to incomplete or missing data at birth (including early neonatal deaths), incomplete data on maternal violence exposure, or severe medical conditions. A further 233 children were lost to follow-up because of out-migration or being absent from home during 3 subsequent home visits, 32 infants were initially included but died before the first home visit, and 3 mothers refused to participate. Finally, a cohort of 3132 live-born singletons with complete maternal violence data and at least 1 recall period assessed was available for the 12-month follow-up. Altogether, 33 527 home visits were done and, as every home visit covered a 7-day recall period, information on 234 689 person-days of recall were gathered. An average of 10.7 of 12 scheduled visits per mother-child pair were completed. Mothers of children lost to follow-up did not differ in socioeconomic status or exposure to partner violence compared with study participants.

STATISTICAL ANALYSIS

The individual child was the unit of analysis, and a model was constructed to evaluate the association between maternal exposure to family violence and infant morbidity. To calculate incidence rates of diarrheal and respiratory tract infections for different groups or time intervals, the numerator consisted of episodes with the specific symptom, and the denominator was the total number of person-time reported (based on the monthly 7-day recall). The relative risk of falling ill was analyzed in relation to exposure to violence using individual episode counts as outcome variables and person-time observed as rate multipliers in Poisson regression models.

The following factors were considered possible confounders: maternal intervention groups, maternal age and education, parity (birth order of child), household asset score, exclusive breastfeeding, birth weight, maternal weight, and religion. Adjustment for religious affiliation (being Muslim or Hindu) was done because associations between religion and violence against women as well as religion and infant illness were found and were independent of other confounding factors such as socioeconomic conditions. In addition, an association between religion and women's violence exposure has previously been described.[26]

Any cofactor with a *P* of less than .20 for any linear or nonlinear association with infant morbidity and with exposure history to violence was initially included; however, if the measured variable influenced the effect estimate less than 5% it was excluded from the final model. Data were analyzed with the Statistical Package for Social Sciences (Version 12.01; SPSS Inc, Chicago, Illinois) and Poisson regressions with EGRET (Version 2.0; Cytel Software Corporation, Cambridge, Massachusetts).

ETHICS

Informed consent was obtained from the participating women, and data were handled with strict confidentiality. The study was reviewed and approved by the Ethical Review Committee at International Centre for Diarrhoeal Disease Research Dhaka, Bangladesh. Children with reported illness were assessed clinically and referred to health services whenever required, and women reporting experience of violence were offered counseling services.

RESULTS

The mean (SD) age of the pregnant women was 26 (5.8) years (range, 14-44 years) at enrollment, and 32% were expecting their first child (range, 1-11 children per mother). One-third of the women had fewer than 3 years of formal education, 86% were Muslims, and 14% were Hindu. Almost all were currently married (1% divorced or widowed), and 92% were housewives who did not participate in any income-earning activities. The mean (SD) pregnancy duration was 39.1 (1.60) weeks (range, 30-43 weeks). The children (male to female ratio, 1.05) had mean (SD) birth weight of 2701 (401) g (range, 1180-4250 g), and 33% had a low weight at birth (<2500 g). Thirty-four percent of the infants had stunted growth (length for age <−2 SD), and 29% were underweight (weight for age <−2 SD) at 12 months. Initiation of breastfeeding was universal and of long duration (90%>1 year) but the median duration of exclusive breastfeeding was only 105 days.

Lifetime experience of any form of family violence was reported by 50% of the mothers; the exposure for different forms of family violence is presented in Table 1. Mothers' experience of any form of family violence as well as lifetime physical and severe physical, sexual, and emotional violence were more common among Muslims than Hindus, the poor (low asset scores), those with low educational levels, older persons, and multipara. Similarly, a high level of controlling behavior was reported more frequently among women who were Muslims, had low asset scores, and had low educational levels. All forms of family violence were associated with lower birth weight of the offspring. Severe physical violence, but no other form of violence, was positively associated with duration (longer) of exclusive breastfeeding. Women's exposure to violence did not differ between the food interventions groups or the 2 breastfeeding counseling groups.

Incidence rates of diarrheal and respiratory symptoms, overall and in relation to mothers' exposure to different forms of family violence, are shown in **Table 2**. The incidence of diarrheal symptoms showed almost no variation by sex and was more frequent in the 7 to 12–month interval (4.6 episodes per person-year) compared with the first 6 months of infant life (2.9 episodes per person-year). Respiratory tract infections (cough, breathing difficulties, rapid breathing in combination with fever) were overall more commonly reported in boys than girls, and almost equally distributed over the first and second half of infancy. Three-hundred forty children (10.8%) with an average recall period of 66 days per child had neither diarrheal nor respiratory symptoms reported at any time. Incidence rates of diarrheal and respiratory symptoms were positively associated with no or little maternal education, low asset score, higher birth order, and being Muslim ($P<.05$). Low birth weight and short gestation were not associated with the incidence rate of diarrheal episodes nor with respiratory symptoms.

Table 2. Incidence of Symptoms Related to Sex and Mother's Experience of Different Forms of Family Violence[a]

Characteristics	Total	Girls	Boys	No Family Violence	Any Family Violence	Any Physical Violence	Any Severe Physical Violence	Physical Violence This Pregnancy	High Control in Marriage
Children, No.	3132	1523	1609	1582	1550	694	248	236	559
Recall, person-days	234 689	114 607	120 082	118 987	115 702	51 465	18 980	17 520	41 975
Symptoms, mean episodes per person-year, No.									
Diarrhea[b]	3.9	3.9	3.9	3.5	4.4	4.6	4.6	4.8	4.4
Acute respiratory tract infection[c]	10.7	10.1	11.3	9.9	11.5	11.9	12.4	12.0	12.1
Acute pneumonia[d]	2.2	1.9	2.4	1.8	2.5	2.8	3.3	2.8	2.7

[a] Per person-days in 3132 rural Bangladeshi infants aged 1 to 12 months.
[b] Three or more loose stools per 24 hours.
[c] Cough and fever.
[d] Cough and/or breathing difficulties, rapid breathing, and fever.

Table 3. Adjusted Rate Ratios for Episodes of Diarrheal Diseases and Lower Respiratory Tract Infections Among Infants Based on Maternal Exposure to Different Forms of Family Violence[a]

	Rate Ratio (95% Confidence Interval)			
Mothers' Exposure to Violence[b]	Diarrhea, All Children (N=3132)	Pneumonia, All Children (N=3132)	Girls (n=1523)	Boys (n=1609)
No violence of any form	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Any violence	1.20 (1.10-1.30)	1.31 (1.17-1.46)	1.43 (1.19-1.69)	1.22 (1.06-1.41)
Lifetime physical violence	1.21 (1.09-1.35)	1.31 (1.15-1.50)	1.37 (1.11-1.69)	1.26 (1.05-1.51)
Lifetime severe physical violence	1.28 (1.10-1.48)	1.51 (1.26-1.80)	1.71 (1.31-2.25)	1.36 (1.07-1.72)
Physical violence during actual pregnancy	1.24 (1.08-1.42)	1.25 (1.05-1.49)	1.51 (1.17-1.95)	1.06 (0.80-1.35)[c]
Lifetime sexual violence	1.21 (1.10-1.33)	1.39 (1.23-1.57)	1.47 (1.22-1.78)	1.33 (1.14-1.57)
Lifetime emotional violence	1.25 (1.14-1.38)	1.39 (1.23-1.58)	1.62 (1.34-1.97)	1.25 (1.05-1.48)
High level of control (≥2/5 items)	1.24 (1.12-1.38)	1.37 (1.19-1.57)	1.59 (1.29-1.97)	1.21 (1.00-1.47)

[a] A total of 3132 rural Bangladeshi infants were followed up from 1 to 12 months of age. Lower respiratory tract infections included cough and/or difficult breathing, rapid breathing, and fever.
[b] Compared with children of mothers with no experience of partner violence at all, adjusted for asset score (high or low), mothers' educational level (≥7, 3-6, or <3 y of schooling), parity (first, 2-3, >3 live births), and religion (Muslim, Hindu). Duration of exclusive breastfeeding, birth weight, and maternal weight were not confounding factors.
[c] $P \leq .05$ for all except this value.

Children of mothers exposed to different forms of family violence had 26% to 37% higher incidence (unadjusted) of diarrheal diseases and 16% to 83% higher incidence (unadjusted) of respiratory infection episodes per person-year than children of women who were not abused. The positive association between violence against women and incidence of lower respiratory tract infections tended to be more pronounced for daughters than sons and more marked in relation to more severe violence.

After adjusting for asset score, religion, maternal educational level, and birth order of infant, there was a positive association between mothers' exposure to any form of violence and the risk of falling ill with diarrhea (rate ratio, 1.20; 95% confidence interval, 1.19-1.39) and respiratory tract infections (rate ratio, 1.31; 95% confidence interval, 1.17-1.46), assessed with the Poisson regression model (**Table 3**). Lifetime physical violence, lifetime severe physical violence, physical violence during the ongoing pregnancy, lifetime sexual violence, lifetime emotional violence, and high level of control in marriage were all independently and positively associated with incidence of disease symptoms. In addition, mothers' exposure to family violence increased the proportion of observed days with diarrheal or respiratory symptoms.

Incidence rates for pneumonia were assessed among boys and girls (Table 3). When assessing diarrhea and overall acute respiratory infection symptoms, there were no or only small differences in rate ratios between sex (not shown). Further, stunted (length for age <–2 SD) as well as nonstunted (length for age ≥–2 SD) infants of abused mothers presented very similar increases in risk of falling ill with diarrheal or respiratory tract infections compared with infants of women who were not abused.

COMMENT

Diarrhea and respiratory tract infections contribute more than any other illnesses to infant morbidity and mortality in the developing world.[16,21] In this study we found that, after adjusting for potential confounding factors, family violence against women significantly increased the risk of infants having those diseases. Any form of family violence, independent of timing, as well as controlling behavior without physical assault, were risk factors, and se-

vere physical violence, a female child, and younger age of the child further increased the risk.

Data from a cross-sectional study in Uganda has previously suggested an association between partner violence and diarrhea and overall infant illness.[13] However, our study has methodological advantages: a community-based, prospective, longitudinal design with monthly morbidity recalls during the infants' first year of life, generating more than 200 000 days of observation.

The incidence rates of diarrhea and respiratory tract infections in our study are consistent with former studies performed in the region; Pathela et al[27] reported an overall incidence of diarrhea of 4.25 per child-year in rural Bangladesh. In a review of respiratory tract infections among children in Asia, the incidence of overall respiratory tract infections was 6 to 9, and pneumonia 0.1 to 1.2, per person-year[28]; children up to 5 years of age were included, which could explain a slightly higher incidence rate in our study, as we included only infants. Short recall periods (in our study, 7 days) reduce the risk of recall bias and improve the quality of caregiver-reported morbidity data.[29] The definition of diarrhea was simple; thus, mothers can reliably report diarrheal episodes.[17] Caregiver-reported respiratory symptoms are known to be less specific than caregiver-reported diarrheal episodes.[21] However, fast breathing and fever, the symptoms interpreted as pneumonia in our study, were considered to provide the highest positive predictive value for pneumonia in self-reporting.[30,31]

Underreporting of exposure to violence is possible, as the results showed a lower proportion of women reporting experience of partner violence than in the WHO-coordinated study previously performed in the area.[1,15] Interviewers collected information on experiences of violence in private after receiving careful training. However, the protocol included several other time-consuming study procedures, which may result in some underreporting of experiences of violence.[32] If underreporting of violence exposure (ie, nondifferential misclassification) is the case in this study, our results could underestimate the significance of violence as a risk factor for infant morbidity.

The increased risk of infant morbidity related to mothers' exposure to family violence could partly be explained by an increase in risk of low birth weight and undernutrition during infancy, a well-described risk factor for infant morbidity.[16,33] Several studies[3-5] have described associations between violence against women and low birth weight of the offspring. Hasselman and Reichenheim[34] showed an association between partner violence and acute malnutrition among small children in Brazil. We have previously shown that violence against women increased the risk of smaller size at birth, growth stunting, and underweight during the first 2 years of life in the same study population.[35] In the present data, low birth weight was not significantly related to increased incidence rates of diarrhea or respiratory tract infections, even through there was a numerical tendency in that direction. Further, undernutrition during infancy could not be the only association between violence and infant morbidity, as stratification for nutritional status revealed almost the same increase in morbidity risks for the stunted and underweight as for the well-nourished infants of abused mothers.

The duration and exclusiveness of breastfeeding may explain differences in morbidity among infants.[36,37] In this study the duration of exclusive breastfeeding did not differ in relation to mothers' violence exposure, except in a small group of severely abused women who breastfed exclusively for longer than others. Other feeding and weaning practices were not assessed in the present study.

Perhaps most importantly, an association between family violence and infant morbidity could be explained by abused mothers being depressed, emotionally stressed, and socially isolated.[2,6,38] This reduces a mother's ability to cope with the everyday needs of a small child and diminishes the quality of care giving behavior, which is important in preventing infant morbidity.[39-41] Further, caring for a sick child requires investment in time and dedication and the recovery from episodes of diarrheal or respiratory tract infections are dependent on the presence and ability of the primary caregiver, ie, the mother.[42,43]

In addition, abused women are less likely to be able to seek external support when needed.[39] We have no information on use of health services in this study, a limitation when trying to understand the relationship between violence against mothers and infant morbidity. Our data indicate a higher increase in risk of getting pneumonia among daughters than sons of abused mothers. This corresponds to earlier findings from the area where gender-biased consequences of partner violence for child mortality were found[10] and might be explained by differences in child rearing and health care–seeking practices for girls and boys.[19,20]

We conclude that family violence against women increases the risk of the most common and important diseases in infancy. This could, at least partly, explain our previously reported findings that violence may increase the risk of infant mortality.[9,10] The present findings add to the increasing evidence of the magnitude of public health consequences of violence against women, and the findings might be especially relevant in settings with high level of infant morbidity and mortality.

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